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ABSTRACT

Described are the efforts of generating and implementing a generic model for program development at a kindergarten through sixth-grade elementary school in order to satisfy identified needs for program improvements in science. The implementation of the program involved a steering committee, the teaching staff, community members and external specialists. This publication consists of two major sections. The first section, which presents the practicum report, contains four chapters and a bibliography. The second section, which presents the appendices, includes: (1) Procedures for implementing school based management of program development; (2) Component design for staff development; and (3) Selected activities and assessment items. (HM)

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GENERATING AND IMPLEMENTING
SCHOOL BASED MANAGEMENT OF
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1978

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GENERATING AND IMPLEMENTING SCHOOL BASED MANAGEMENT OF PROGRAM DEVELOPMENT

by Jean Moeller[1]

Submitted in partial fulfillment of the
requirements of the National Ed. D. Program
for Educational Leaders, Nova University.

Individual Practicum Report
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ABSTRACT

AUTHOR	Moeller, [illegible]an
TITLE	Generating and Implementing School Based Management of Program Development
DESCRIPTORS	Curriculum Development; Educational Programs; *Elementary School Curriculum; Organizational Development; *Program Development; *Science Course Improvement Project; Training Techniques
ABSTRACT	A management system for developing instructional programs at local school sites was generated and implemented at a kindergarten through sixth grade elementary school in order to satisfy identified needs for program improvements in science. The implementation of the generic program development model involved a steering committee, the teaching staff, community members, and external specialists. Staff development activities and other procedures were provided as needed for developing school level decision making skills. The program development included such activities as comparing the school's needs to the attributes of other existing programs, organizing the program's objectives, selecting materials, introducing the program, and providing for continuation. The results of an "Observable Criteria Checklist" and the reactions of parents, teachers, and students before and after program implementation were utilized to describe the effectiveness of the new program. The evaluation component also made use of student data from a school not affected by program intervention in an analysis of matched pairs of pretest to posttest differences. The school based management system resulted in the application of significant program improvements and the development of local decision making skills that subsequently affected program improvements in other areas. (Included in the appendices are such items as a curriculum bulletin in elementary school science education, a procedures manual for schcol based management of program development, and a component design for staff development.)

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PREFACE

This practicum was conceived in response to needs expressed by community members and school personnel at Pinecrest Elementary School, 10250 S. W. 57th Avenue, Miami, Florida 33156. The practicum report is a narrative account of efforts to generate and implement a generic model for program development. The report is organized in a logical progression similar to the design of the practicum process.

The first chapter includes the background information. Consideration is given to the problem, the setting, the needs, the objectives, and the development of the strategy.

Next, the method used to carry out the strategy is described in an account of events and program components.

In the third chapter, data are presented, analyzed, and interpreted.

The final chapter contains conclusions and recommendations.

The reference matter includes such documents as a selected bibliography and the products generated as a part of the practicum effort.

Thus, the report proceeds, sequentially, from the statement of the problem to the description of the conclusions.

Practicum activities were expedited by the helpful suggestions and expertise of Mrs. Dorothy C. Isbell, Staff Director, South Area Schools, and Mrs. Harriet Ehrhard, Science Consultant, Dade County Public Schools. In addition, the process of practicum implementation was fully supported by Mr. Michael Liebman, Principal, Pinecrest Elementary School. The professional assistance provided by these educators was especially beneficial and highly appreciated.

CHAPTER 1

INTRODUCTION

1.1 THE PROBLEM

In the face of declining central office support, societal demands for effective educational programs accelerated. Environmental conditions had resulted in a growing cognizance by school personnel and community members of the strengths and weaknesses of existing programs. In some instances, the application of available resources had provided centralized responses disproportionate to the satisfaction of the various local program needs.

For example, previous district efforts had resulted in the desired major program improvements in reading and mathematics. However, plans for implementing and continuing the program changes had somewhat reduced the availability of resources. Consequently, efforts to satisfy some other program needs were curtailed.

At Pinecrest Elementary School, concerns had often been related to the various weaknesses in the science program. The vacillating textbook adoptions and questionable learning sequence were among the areas cited. Other concerns were generally more closely associated with individual school personnel and student circumstances. Local efforts were required for resolution.

Thus, a school based management system was needed to provide for the greater than previous demand for program development efforts at the school level.[2]

1.1.1 Local Educational Arena

An investigation of the local educational arena (LEA) revealed some pertinent data.

The school was located within a large, urban school district. The upper middle class neighborhood was occupied primarily by middle management and professional people, who, although actively engaged in social and business pursuits, were involved in school activities and supportive of their children's learning. The 850 member, generally college bound, white student population often scored in keeping with expectancies on standardized tests, the results of which were published in the city newspaper.

The 20 year old school plant consisted mainly of rows of individual classrooms. Some adjoining walls had been removed. The 28 kindergarten through sixth grade teachers were organized by grade level teams of two teachers each. Within the team organization, teachers were provided with opportunities to specialize and/or organize on the basis of teacher interest, particular strength, or student needs. Since there was a low pupil and teacher transiency rate, the average classroom size was sustained at about 29 throughout the year.

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[2] For a detailed discussion of needs see section 1.1.2 below.

Two main organizations provided the necessary structure for school/community involvement. The Parent-Teacher Association Board consisted of approximately 40 representative parents. The Citizens' Advisory Board, however, was a 15 to 25 member group composed of parents, teachers, administrators, P. T. A. Board representatives, and other interested persons. While the P. T. A. Board was primarily a steering committee for fund raising and other support services, the function of the Citizens' Advisory Board was to react, recommend, and otherwise work for school and community improvements.

A number of other factors in the LEA influenced the determination of program selection and change strategies.

(1) For many years, the district's central office had provided support for local schools in such areas as data processing, evaluation, pupil personnel services, account budgeting, curriculum consultants, program development and innovation, and staff development. Due to a continuing decline in the availability of funds, district plans for the future projected a gradually decreasing level of centralized support for local schools in the areas of staff development, program development and innovation, and support personnel.

(2) At the school level, reactions to program changes were generally guarded. Experienced members of the teaching staff had often described their concerns for the extent of program transiency throughout the district.

(3) The effects on local schools, school personnel, and various areas of the curriculum of the latest and most lasting

program to be centrally introduced into the system remained. During the four years since the program's inception, the local effort necessary to provide monetary and support help and to raise personnel involvement and expertise to an acceptable level was rewarded by successful implementation. A closer examination of the total situation, however, revealed the somewhat detrimental side effects or other facets of the curriculum and on school resources.

(4) Local schools were required by the state to publish and send to parents an Annual Report of School Progress. The report included a comprehensive description of the status of the school's educational program and student population. The document sometimes included the results of a needs assessment.

(5) Over a period of years, the cooperative efforts of school level educators and parents had generally resulted in the desired school improvements. Thus, local initiative was rewarded, and the involved persons continued to react constructively to satisfy indications of existing school needs. Within the context of the situation, however, participants were aware of the inherent limitations of their efforts and, wisely, chose only those projects with good potential for realistic accomplishment. Although positive attitudes toward such endeavors had been developed and sustained, the limitations of resources and local decision making skills continued to restrict the intervention potential.

1.1.2 Identification of Needs

Within the LEA, needs often implicated various program development or implementation deficiencies.

1.1.2.1 Alleged Needs[3]

In dialogs regarding the strengths and weaknesses of the school's instructional programs, school personnel and community members consistently attested to the following alleged needs:

(1) the needs of teachers to have available for use a schoolwide and grade level sequence of objectives to guide planning for instruction (Evidence of Needs - 1, 2, 5);

(2) the needs of teachers to be apprised of teaching strategies for exclusive use at each grade level (Evidence of Needs - 1, 2, 5);

(3) the needs of teachers to be provided with organized, grade level materials to accompany designated teaching strategies (Evidence of Needs - 3, 4, 6);

(4) the needs of teachers to be provided with guidelines for the use of resources in teaching to designated objectives (Evidence of Needs - 1);

(5) the needs of school personnel and students for continuity and sequence in learning that does not vacillate with each new material or textbook introduced into the system (Evidence of Needs - 3, 4, 5);

---

[3] At the conclusion of each alleged need, reference is made in parentheses to the corresponding Evidence of Needs in section 1.1.2.2 below.

(6) the needs of students to be provided with continuous progress in the development of behavioral and cognitive skills (Evidence of Needs - 5, 6); and

(7) the needs of school personnel, the school system, and parents to provide an effective learning situation for students.

1.1.2.2 Evidence of Needs

An examination of the LEA revealed that the needs for school based management of program development and for the improvement of the local school's science program were interrelated. Thus, the following data provided implications for the substantiation of the total multi-component practicum effort.

(1) Since the advent of Sputnik and, later, the rejection of the American Association for the Advancement of Science (AAAS) Program, societal pressures and legislative priorities for the refinement of the basic skills of reading and mathematics had so consumed educational efforts that elementary science and other areas of the curriculum were required to assume a posture of lesser importance. Existing needs in these areas were generally unrequited. Teacher-interviews indicated three main reasons for the rejection of the AAAS Program: (a) the program's extensive demand for and incomplete supply of materials required for implementation, (b) long-term centralized maintenance and retrieval of materials diffculties, and (c) the nature of the change strategy as introduction was attempted.

(2) Records of classroom observations over the past six years revealed at the 95 percent level that teachers tended to plan for the science period those activities that were necessary for the substantiation of report card grades. In this endeavor, as evidenced by the observations and the perusal of planbooks, the strategy most often employed was that of proceeding through the textbook by requiring students to write responses to the textbook questions.

(3) In November 1975, a committee of parents met with school administrators in an attempt to develop a sequence of skills and enrich the teaching strategies utilized in the science program. The parents offered their services in support of renewed efforts for program development in science.

(4) A materials' inventory, conducted in December 1975, reinforced the hypothesis that, during the years since the rerouting of priorities, the purchase of science materials had been limited to textbook selections and, more recently, supplemented by kits for individualizing instruction.

(5) In 1974, a number of science kits had been purchased in response to teacher requests for science activities to support the independent learning stations of the recently initiated basic skills classroom organization. Some teachers expressed concern for the decreasing number of daily direct teacher contacts with individual students. Since these teachers had interpreted the decreased contacts as an effect of the encroachment of the new basic skills program, they were hesitant to extend the situation by utilizing the kits. Other teachers, however, reacted to the purchase of the individualized science

kits by planning to further integrate the school day with open classroom types of organized activities.

(6) Prior to the determination of the school objectives for the 1975-76 school year, the teaching staff, the Citizens' Advisory Board, and the student council representatives responded to a "Needs Assessment" opinionnaire. This procedure assessed various attitudes toward the school's educational program and provided guidance for determining school priorities. The results of the opinionnaire were published in the June 1976, Annual Report of School Progress. The report specified the average priority ranking given to objectives on an open-ended list by each of the three population groups and by the total of all respondent groups. On a scale of 1 to 12 from "highest priority" to "lowest priority", the responses were specified as indicators of school needs. An analysis of the data presented in figure 1, "Visualizing Priorities in School Needs," revealed that "Science" and/or its related component, "Problem Solving", were listed among the top five priority objectives by both citizens and staff. The relatively low priority assigned to science by the student population was explained by an investigation of the students' low transiency rate, resulting limited frame of reference in the area of science, and general basic skills orientation.

AVERAGE RANKING OF OBJECTIVES BY PRIORITY	1=highest need 12=lowest need			
	STAFF	CITIZENS	STUDENTS	TOTAL
Science	4	8	9	7
Problem Solving	2	5	7	3.5
Interpersonal Relationships	5	12	2	6
Study Habits	6	3	3	2
Basic Skills	1	1	1	1
Decision Making	10	10.5	12	12
Vocabulary	8.5	2	5	5
Discipline	3	7	4	3.5
Humanistic Values	7	9	11	10
Enrichment Activities	11	10.5	8	11
Creative Writing	11	10.5	8	11
Quantity of Reading	12	4	6	8

Figure 1

VISUALIZING PRIORITIES IN SCHOOL NEEDS

(7) Over a four year period, 100 percent of all classroom teachers had been trained in the new diagnostic/prescriptive approach to basic skills instruction. In addition, during this period of time legislative support and local funds had enabled classrooms to be supplied with the appropriate equipment and materials to a degree never before realized. The effectiveness of the new basic skills program increased the visibility

of the strengths and weaknesses of other instructional programs. Finally, it was unrealistic to assume that the decreasing central office resources would affect such major program improvements in another curricular area.

1.1.2.3 Effect on Other Needs

An analysis of school data revealed that the school level decision making skills developed for program improvements in science would, ultimately, provide support for the satisfaction of certain other school needs. For example, the program's generic decision making skills were applicable to a variety of individual classroom and schoolwide situations. The process of program development would also provide productive involvement for parents and opportunities for decision making by those who would be required to implement. In addition, benefits would be derived from changes that were readily accepted into the system.

Consideration was also given to the effect of the program development on school resources. Only a minimum of funds would be required for duplicating the program and purchasing the materials. Conversely, time demands would be much greater. The efforts of school personnel and community members would be rerouted to support the program activities. The concerns would be primarily temporal.

In short, the program development was not generally associated with adverse effects on other needs. Rather, other school level improvement efforts would be encouraged by the implementation of the practicum activities.

The previous examinations of the school and its needs served to reinforce the advisability of proceeding with plans for program development at the school site. The next task was to specify the desired accomplishments by structuring the objectives.

1.2 THE OBJECTIVES

The intent of the practicum effort was to increase the effectiveness of the science program by implementing change strategies at the school level. This intent was specified in the practicum's four terminal objectives, which, when achieved, were designed to solve the problem and satisfy the identified needs. In addition, four management objectives were generated as indicators of the operation of the practicum. The four process and four product objectives were developed as statements of intermediate accomplishments necessary to the support of the terminal objectives.

1.2.1 Summary of Specifications

As a result of the examination of such data as the implications of the existing needs, various factors emerged as the desirable attributes of the practicum effort. The attributes were interspersed throughout the practicum effort as specifications for generating the practicum objectives. The data displayed in figure 2, "Generating Objectives," provided the basis for retrieving and organizing the data, summarizing the specifications, and generating the objectives.

NEEDS →		OBJECTIVES
Primary Source of Evidence[4] →	Specification →	Response
Classroom Observation Forms (2)	Continuity, Sequence	TERMINAL 1. Student Learning
Materials' Inventory (4)	Adequate Materials	2. Student Application
Needs Assessment (6)	Program Development	3. Teacher Acquisition
Parent Committee Conference Log (3)	Strategy, Continuity	4. Teacher Application
LEA Data	Acceptance of Change	MANAGEMENT 5. Program Development Procedures
LEA Data	Continuance, Initiation	6. Revision Procedures
In-service Side Effects (5)	Realistic Considerations	7. Implementation Procedures
In-service History (1)	School Site Organization	8. Continuation Procedures
Teachers' Planbooks (2)	Objectives, Strategies, Assessment	PROCESS 9. Prepare Program Content
Program Comparison (7)	Trial Periods, Revisions	10. Evaluate Effectiveness
In-service History (1)	Internal Facilitators	11. Introduce and Support
LEA Data	Low Cost, Valid	12. Maintain and Refine
County Curriculum Bulletins	Internal Development	PRODUCT 13. Curriculum Bulletin
In-service Side Effects (5)	Flexible Adaptation	14. Resources Supplement
In-service Side Effects (5)	Teacher Individuality	15. Staff Development Module
Program History (1)	Acceptance, Continuation	16. School Based Management

Figure 2

GENERATING OBJECTIVES

---

[4] The numbers in parentheses refer to the corresponding description of Evidence of Needs in section 1.1.2.2.

1.2.2 Terminal Objectives

(1a) Given the pretest and posttest scores of students effected by program intervention, an increased number of correct posttest responses would be indicated by 95 percent of student scores.

(1b) Given the pretest and posttest scores of students from a school not effected by program intervention paired with those of students from the local school site on the basis of pretest class interval score similarities, the greater increase in the number of correct responses of the pair would be indicated by 70 percent of local school site paired scores.

(2) Given the presentation of a problem situation by an external observer, components of the scientific method would be appropriately used in the solution process by two out of the three students questioned in the effected classrooms.

(3a) Given the conclusion of the second quinmester of the 1976-77 school year, the program objectives would be utilized as a framework for instructional planning by 100 percent of science teachers.

(3b) Given the conclusion of the second quinmester of the 1976-77 school year, the program objectives, teaching strategies, and training suggestions would be utilized to supplement instruction by 75 percent of science teachers.

(3c) Given the average pretest to posttest increase in the number of correct responses by students of teachers with full program implementation and by students of teachers with partial program implementation, the greater average increase in the number of correct responses would be indicated by students of teachers with full program implementation.

(4) Given the conclusion of the 1976-77 school year, a satisfactory level of full program implementation would be demonstrated by 60 percent of science teachers.

1.2.3 Management Objectives

(5) Given the implementation of the initial planning activities of the school based management system, the staff development component would be generated and implemented by the application of the designated procedures.

(6) Given the generation of the initial program components, reevaluation and revision activities would be implemented by the application of the designated procedures.

(7) Given the implementation of the program components, existing teachers would be supported and new teachers installed into the system by the application of the designated procedures.

(8) Given the implementation of the program components, the program would be maintained and continued by the application of the designated procedures.

1.2.4 Process Objectives

(9a) Given the implementation of the organizational plans of the school based management system, objectives and evaluative criteria would be organized sequentially for each grade level by the appropriate school personnel.

(9b) Given the organized objectives and evaluative criteria, eight selected teaching strategies relating to the designated objectives would be developed for exclusive use at each grade level by the appropriate school personnel.

(9c) Given the selected teaching strategies, materials would be provided and organized by the appropriate school personnel and volunteer aides.

(10a) Given the experimental edition of the program, trial periods and revisions would be implemented by school personnel.

(10b) Given the revised program, the program would be evaluated by school personnel, community members, and external professionals (as available).

(11a) Given the implementation of the school based management system, the staff development module would be generated, scheduled, and supported in a request for in-service credit for participants by the writer.

(11b) Given the generation of the staff development module, the program would be introduced and supported by the writer and the participants.

(12) Given the introduction of the program, periodic reevaluation and revision procedures and continuation plans would be implemented by school personnel.

1.2.5 Product Objectives

(13) Given the implementation of the practicum effort, the appropriate curriculum bulletin would be provided, introduced, and disseminated by the writer.

(14) Given the evaluation of the program, supplements and/or revisions would be provided and introduced by the writer.

(15) Given the initiation of the practicum effort, a staff development component design would be generated, introduced, and disseminated by the writer.

(16) Given the implementation of the practicum effort, a procedures manual for school based management of program development would be generated and disseminated by the writer.

Thus, a general description of the desired outcome was provided by the specifications of the objectives. Next, consideration was given to a strategy for accomplishing the objectives.

1.3 CONCEPTUALIZING A SOLUTION

Prior to the formulation of the strategy, the applicable data were examined. First, the literature was searched. Next, the work of others was collected and analyzed. Finally, alternative solutions were considered.

1.3.1 Literature

The search of the literature from the private and public sectors exposed an abundance of materials relating to the various facets of the practicum effort. A closer examination revealed that a preponderance of the materials attested to the wisdom and, in some instances, the necessity of the application of school level decision making in program improvement efforts.

For example, the literature typically indicated that, if program plans were to succeed, the administrative organization would need to provide for development or input into the development by the personnel who must implement and continue the program at the local school site. In The National Elementary School Principal, Cross elaborates on the implications of these organizational provisions.

> Expectations of dramatic improvements through adoption of 'the program' are being replaced by the idea of continuous improvement through evaluation and planning, constructed by the school faculty under the leadership of the principal.[5]

Within the framework of the decentralized organization, a shift in the administrator's role was described.

> (The change in the administrator's role) is from direct control and direct interpretation of what is happening in the environment to concern with understanding the logic of production (and) developing effective processes and linkages . . .[6]

Effective plans for program improvement generally included attributes designed to:

(1) draw out the best others have to offer,

(2) sustain the procedure until improvement is accomplished,[7] and

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[5] Ray Cross, "The Administrative Team or Decentralization," The National Elementary Principal 54 (November 1974):81.

[6] Peter Drucker, Management: Tasks, Responsibilities, Practices (New York: Harper and Row, 1974), Chapter 23.

[7] Louis J. Rubin, Curriculum Development: A Study Guide for Educational Administrators (Ft. Lauderdale, Fla.: Nova University Press, 1974), p. 146.

> (3) take advantage of a faculty's commitment to its program decisions.[8]

Although the involvement of various school personnel and community members was considered appropriate throughout the operation of the program, the major responsibilities were desirably assumed by a steering committee consisting of no fewer than five and no more than 15 members. Mansbridge alluded to the size of the ideal working group.

> The benefits of direct democracy can best be achieved in a small (5-15 member) group because of more flexible, fast, adaptive, and accurate responses to situations, production of more creative and innovative risk-taking results, possibility of more correct answers with consensus, and increase in individual commitment due to face-to-face contact.[9]

An appointed coordinator was considered to have the greatest leadership potential in an ideal working group.

> Three problems arise when groups try to make their decisions in a face-to-face, nonhierarchal, leaderless way. . . (1) The decision takes longer to make. (2) The issues become personalized. (3) Ingrained inequalities cannot often be weaned out.[10]

Activities to effectively operate and implement program development consistently provided every participant with a realistic work load. Rubin alluded to this area of concern.

> The implication to be drawn is not that organizations need people who are more self-sacrificing, but rather that leadership must accept the reality of personal goals which may undermine organizational ones.[11]

---

[8] Cross, "The Administrative Team," p. 82.

[9] Jane Mansbridge, "Time, Emotion, and Inequality: Three Problems of Participatory Groups," The Journal of Applied Behavioral Science 9 (March 1973):354.

[10] Ibid., p. 364.

[11] Rubin, Curriculum Development, p. 147.

In the literature, the primary task of the initial program development procedures was to generate a framework of objectives within the steering committee's structure. The Florida Citizens' Committee on Education stressed the importance of this task to the success of school based management efforts by stating, "Specific educational objectives for a school are set by the people associated with the school."[12]

In the process of selecting the program objectives, priority was given to providing continuity of learning for students. For example, Bruner indicated that if the results of learning were to be useful, transfer must occur. Retention of vast fragmented information was considered unlikely.

> . . . knowledge one has acquired without sufficient structure to tie it together is knowledge that is likely forgotten. An unconnected set of facts has as pitiably short half-life in memory.[13]

The literature also included implications for generating other program components. Teaching strategies and organized materials were generally specified for the program and required for its acceptance. These components were included to decrease planning time and personnel involvement requirements.

Emphasis was often placed on the importance of providing program attributes that would encourage flexibility of implementation and potential for continuation. For example, the desirable program structure provided for the introduction of future resources and expressions of teacher-individuality. Engel summarized these change factors.

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[12] Oron South, School Based Management (Gainesville, Fla.: Florida Association for Supervision and Curriculum Development Press, 1975), p. 3.

[13] Jerome S. Bruner, The Process of Education (Cambridge, Mass.: Harvard University Press, 1973), p. 31.

> The three (prerequisites in educational change that) we have singled out - decentralization of decision making, information acquisition, and actual choice making among a variety of options . . . - are by no means the only important considerations in the politics of change, but each is significant and indispensable.[14]

Finally, the conditions necessary for institutionalization were specified in the literature. The attributes of school site opportunity to practice, peer support, incentive to participate, and individualized options were minimal program requirements for acceptance into the system.[15]

1.3.2 Critical Competitors

The following procedures were utilized in the process of examining the alternative solutions. First, sample programs related to school based management and science education were collected from the central office, various school sites, and commercial sources. Then, the specifications of the identified school needs from figure 1, "Generating Objectives", were compared to the attributes of each sample. Next, consideration was given to the implications of the literature. Suggestions were also elicited from the appropriate county and area personnel specialists. Finally, the data were analyzed.

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[14] Martin Engel, "Politics and Prerequisites in Educational Change," Phi Delta Kappan 55 (March 1974):459.

[15] Rubin, Curriculum Development, passim.

Since components in the materials of some critical competitors contained desirable features, the programs were thoroughly examined to determine their potential for application into the system and to maximize the benefits for the participants of the results of the work of others. The examination exposed a variety of formats, components, and intents. For example, over a period of years, the State of Florida Department of Education had provided the district with individualized teacher training materials. An analysis of the teacher education modules indicated that some of the Cluster II: Planning Skills for Teachers materials were appropriate for use in the development of local decision making skills by individual or small groups of teachers.[16]

Other materials also provided implications for decision making at the school level. A review of the Dade County Public Schools Master Plan for Staff Development, 1976-1981 resulted in further support for the practicum effort. The document described staff development programs for which inservice credit was authorized. Districts with teacher education centers were allocated state funds and authorized to extend credit for educational training programs meeting the established criteria. As a result, within certain guidelines, school personnel were provided with opportunities to extend their state teaching certificates by participating in authorized staff development programs and/or by earning college credits. Since its inception, the state's teacher education modules had been an integral part of the Master Plan for Staff Development. However, new components were added to the Master Plan on a limited basis by submitting a "Component Design for Developing a New Staff Development Program" (see appendix B) and, if acceptable, obtaining the required district and state approval.[17] For all authorized staff development programs, an abbreviated version of the component design was published and sent to interested persons on request. Generic data from a number of these component designs was quite beneficial to the development of the practicum effort.

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[16] State of Florida Department of Education, Florida Teacher Education Modules (Chipley, Fla.: Panhandle Area Educational Cooperative, 1970), p. ii.

Consideration was also given to the content of the program development: science education. The Bureau of Curriculum and Instruction of the Florida Department of Education generated the Florida Catalog of Science Objectives for use by classroom teachers in planning, implementing, and evaluating instruction in elementary science. The catalog displayed a multitude of elementary school science objectives and related evaluative criteria organized into four main content categories. Criteria established by the State of Florida were used as the specifications for the objectives and test exercises. Validation was provided by elementary school teachers and elementary age students in the areas of communicability and comprehensibility.[18] This document formed the basis for initiating the program development in science.

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[17] Dade County Public Schools Division of Instructional Planning and Support, Master Plan for Staff Development, 1976-1981 (Miami, Fla.: Dade County Public Schools Textbook Department, 1977), pp. 3-18.

At least two of the examined programs had been sponsored by national science organizations: the AAAS Program and the COPES Program. It was interesting to note that, although the two programs represented quite different approaches to the teaching of science, both sets of materials were disseminated in the form of teachers' guides containing science activities individually bound by grade level.

Finally, the examination of materials revealed that none of the individual programs or combinations of the programs were fully satisfactory. The rejections implicated financial, judgmental, and various other concerns. The visual representation of the reasons for rejecting the eight most viable alternative solutions depicted in figure 3, "Considering the Critical Competitors," was generated as a supplement to the data base for developing the practicum strategy.

Next, the preceding examination of the data base was compared to the desired outcomes that were described by the practicum objectives. Thus, a rationale was formulated to describe the basic understandings of the practicum design.

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[18] Bureau of Curriculum and Instruction of the Florida Department of Education, The Florida Catalog of Science Objectives (Chipley, Fla.: Panhandle Area Educational Cooperative, 1974), p. i.

CRITICAL COMPETITORS	BASES FOR REJECTION
1. Utilize for program development the State of Florida Teacher Training Modules.[19]	1a. Incomplete content 1b. Restrictive approach
2. Utilize a series of textbooks as the basis for program organization.	2a. Vacillating textbook adoptions 2b. Questionable sequence of needed skills
3. Utilize limited numbers of copies of various textbooks in each class.	3a. Inadequacy of sequence of skills 3b. Vacillating textbook adoptions
4. Provide each teacher with the Florida Catalog of Objectives as a basis for instruction.	4a. Overwhelming volume of materials 4b. Method of implementation implies questionable learning sequence
5. Reintroduce the AAAS Program.[19]	5a. History of program transiency 5b. Centralized development and organization
6. Introduce the Rand McNally Science Curriculum Improvement Study (SCIS) materials as the total program.	6a. Monetary restrictions 6b. Somewhat arbitrary organization for instruction
7. Introduce the Imperial Individualized Science Program as the total program.	7a. Monetary restrictions 7b. Inflexible demands on organization for instruction
8. Provide each teacher with the New York University COPES Program as a basis for instruction.[19]	8a. Centralized program generation 8b. School based management required for continuation

Figure 3

CONSIDERING THE CRITICAL COMPETITORS

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[19] Consideration was given to the application of these materials as supplementary resources.

CHAPTER 2

PRACTICUM DESIGN

This chapter focuses on the implementation of the practicum. First, a rationale structured in response to the data base provides the basic understandings of the strategy. Next, the strategy for solving the problem and the time sequence are explained. Additional data on the order of events are provided in figure 4, "Visualizing the Time Sequence." Finally, the process of implementation is described in a chronological presentation of the program components. The products that were generated and disseminated as a result of the practicum effort are included in appendices A, B, and C of the reference matter.

2.1 THE STRATEGY

2.1.1 Rationale

When continuous and sequential learning experiences are provided throughout the school years, students benefit. An effective instructional program is responsive to the specific needs and aspirations of the community and to the specifications of the educational system for developing the appropriate cognitive and behavioral skills for students. School level efforts to develop and implement an instructional program result in changes that satisfy existing needs. Changes that are generated by those who must implement readily enjoy acceptance and installation into the system. When programs are developed by those who would implement, the administrator's role shifts to concerns for providing leadership in generating efficient processes for product development and continuation. Realistic work loads must be provided for participants in program development activities. Certain components are required for the minimal support of instructional programs: a sequence of objectives, the appropriate extent of teaching strategies and organized materials, guidelines for the application of related resources, and implications of good potential for continuation of the program. For acceptance into the system, the program structure allows for expressions of needs and individuality and for flexible adaptations. Successful implementation is always accompanied by the appropriate extent of informational and/or training programs for each segment of the involved population. Institutionalization requires strategies for the support of existing teachers, the installation of teachers new to the system, the application of new resources, and the maintenance and continuation of the program. The implementation of school level reevaluation and revision processes is necessary for continuation. The application of external evaluator specialists increases the potential for program validity. When the cooperative efforts of school personnel and community members are focused on program development and implementation, the school is strengthened and learning increases.

2.1.2 Procedures

The major thrust of this practicum was to affect program improvements in science by generating and implementing program development strategies at the school level. The main task group for practicum activities was a six member steering committee consisting of representative school personnel. Committee members assumed the primary responsibilities for developing and implementing the program components. Other school personnel, community members, and external specialists were intermittently involved in the activities. In the program development, consideration was also given to such processes as trial periods and revisions, introduction into the system, and continuation. A component design requesting the authorization of staff development credit for the program development was submitted to the appropriate central office personnel. The practicum effort was implemented, introduced into the system, and evaluated during the 1976-77 school year.

In the process of program development, the writer assumed such leadership roles as that of organizer, initiator, presenter, instructor for staff development, and facilitator of the group process. It was also necessary to generate, delegate, direct, monitor, and supervise the operation of the practicum and the personnel involved.

2.1.3 Chronology

From its inception until the final evaluative analysis of its conclusions, the practicum effort spanned an 18 month period. The first three months were consumed by the development of a data base. Needs were identified, critical competitors were examined, and the literature was searched. In addition, the necessary approvals for continuing with the practicum effort were obtained.

During the fourth month, overall plans for the steering committee and for the practicum were formulated. This preparation also included the acquisition of needed materials.

At the beginning of the fifth month, the steering committee was organized. For the next two months until the conclusion of the school year, steering committee members generated organizational plans, identified program needs, examined critical competitors, and organized objectives and evaluative criteria.

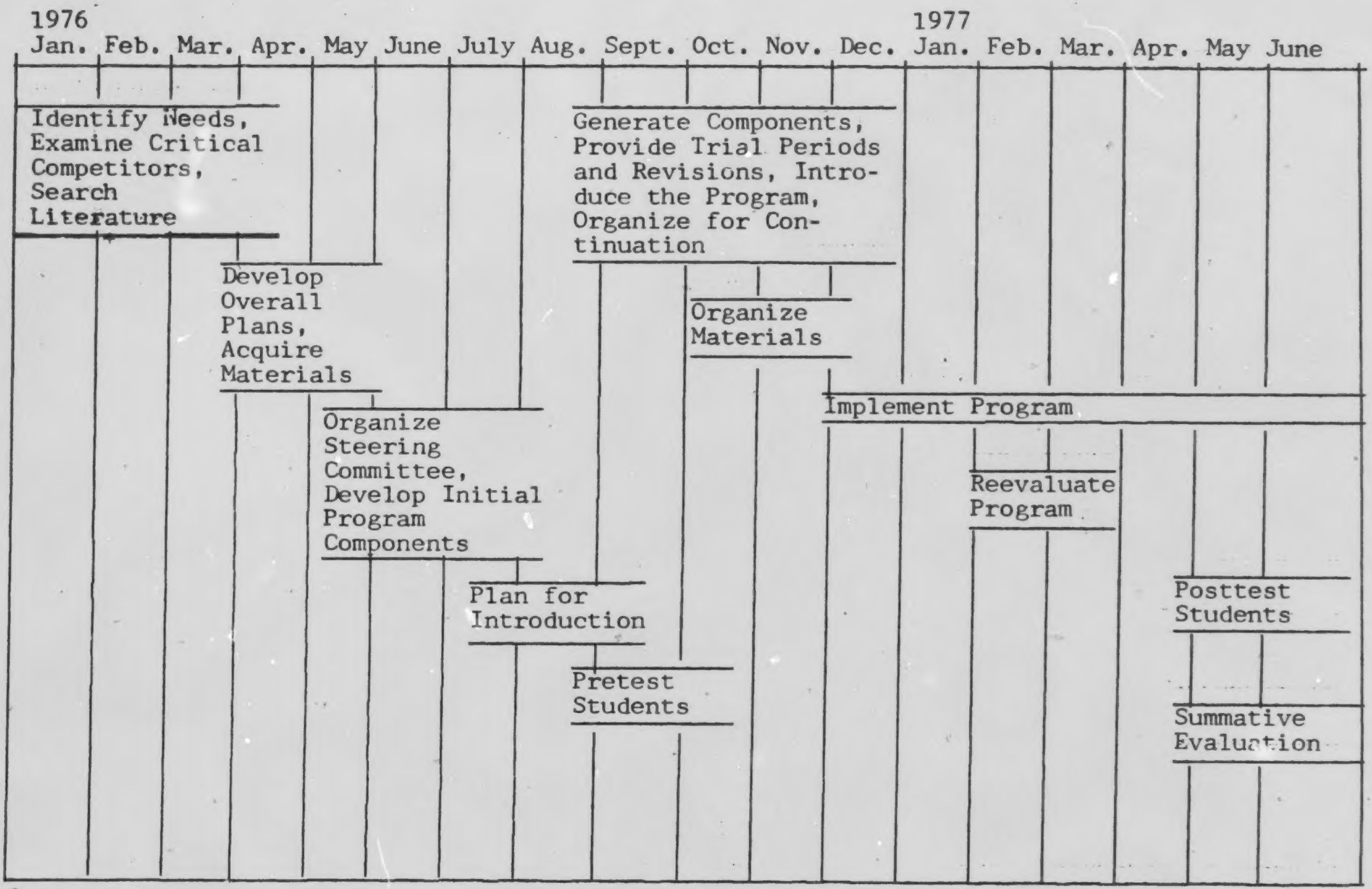
During the last year of the program development, program components were generated and implemented. As the components were developed and introduced, organizational plans provided for trial periods and revisions, implementation and support, and continuation.

In the final month, summative evaluation procedures were applied and analyzed.

The chronology of practicum events was graphically displayed in figure 4 below.

Figure 4

VISUALIZING THE TIME SEQUENCE



2.2 PROGRAM COMPONENTS

The activities of this practicum were initiated in January 1976, by an examination of school needs and concluded in June 1977, by the analyzation of the practicum data.

In November 1975, a group of interested parents expressed their concerns for the science instruction provided for their children. The concerns were reinforced in December 1975, by the results of a materials' inventory and an examination of the school's most recent needs assessment. The implications of other data indicated that school level efforts were required in order to affect the needed improvements.

The steering committee for program development consisted of a school administrator (the writer) and five representative teachers. Initially, the steering committee was concerned with overall planning and organization activities. Later, however, as the participants began to implement strategies for examining the work of others, for organizing objectives and evaluative criteria, and for generating learning activities, the work load increased. Some of the responsibilities were appropriately delegated. Fortunately, the involvement was desired. However, problems centered on the need for more time during the work day. A minimum of rescheduling was required to provide released time for the committee members. Consequently, it was possible to adjust only a few of the special art, music, and Spanish classes in order to provide the participants with extended services from the teacher specialists and consecutively scheduled special classes for released time. Other resources were also secured. A portion of the school's discretionary funds had already been allocated to provide hourly services of paid paraprofessionals to support the basic skills program. The influence of the school's contingency planning had resulted in some built-in flexibility in the scheduling of these services. Subsequently, steering committee members were provided with increased paraprofessional services to further reduce the demands of the work load. Efforts to reroute existing resources were rewarded. Committee activities were facilitated. More important, the added support encouraged the participants to proceed with the program development as planned.

2.2.1 Staff Development

Since the program development specified a complex and protracted effort , consideration was given to a request for the authorization of staff development credit for the activities. Dialogs with the writer's immediate superior and the Staff and Line Directors for the South Area of the Dade County Public Schools indicated the appropriateness of proposing such a staff development plan. Requests for additions to the Master Plan were to be submitted by July 31, of each year. In April 1976, the South Area Staff Director supplied the necessary forms. The "Component Design for Developing a New Staff Development Program" was completed and submitted to the designated office in June 1976. The request included a description of the component, general and specific objectives, evaluative procedures, proposed activities, and estimated costs (see appendix B).

The district's inservice credit was awarded to participants in the form of Professional Incentive Program (PIP) units and/or Master Plan Points (MPP). The credit for staff development components was scheduled on a time formula patterned after college standards for semester hours of coursework. That is, colleges typically required 15 hours of instructional class time for each semester hour of credit. Likewise, district inservice offerings were arranged so that a minimum of 15 hours of instruction was required for an offering earning one PIP unit and 20 MPP, a minimum of 30 hours for two PIP units and 40 MPP, a minimum of 45 hours for three PIP units and 60 MPP, and so forth.[20] An examination of the staff development plans for the school based management system revealed that, over the one year period designated for completion, the program development would require a minimum of 45 hours of instructional class time. Consequently, three PIP units and 60 MPP were specified in the authorization request.

In August 1976, the Area Staff Director informed the writer that the district was authorizing no new elementary school level additions to the Master Plan for the 1976-77 school year. The intent of the action was to further support and, thus, to increase the effectiveness of the newly instituted basic skills program.

Fortunately, participants were not aware of the potential for inservice credit that had been requested as an incentive to efforts for the desired accomplishments. Therefore, no change was indicated. The program development activities proceeded as previously specified in the staff development component design.

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[20] Dade County Public Schools, Master Plan, p. 9.

2.2.2 Initial Plans

In preparation for the organization of the program's steering committee, the necessary approvals were obtained, the materials secured and examined, and the overall plans for the practicum effort completed.

In April 1976, the concept of program development at the local school site was presented to staff members at a general meeting. The concept was not a surprise to many of the teachers as dialogs had often indicated the need for such action. Following the meeting, interested teachers contacted the appropriate grade level chairmen in order to request consideration as representatives in the program development. Five teachers were selected to represent the various levels of learning. These teachers, designated as members of the steering committee, were the major participants in the program development activities.

During the initial meetings, steering committee members generated organizational plans for the operation of the committee and for the program development. Although the writer was the designated leader of the group, an alternate chairman was specified by the group to act in the event of various contingencies. Consideration was also given to the meeting times, the projection of a calendar, the program development activities, the roles of committee members in the activities, personnel and other resources needed, implementation strategies, and provisions for contingencies.

Participants were provided with the available materials for examination. Further data provided for committee members included a review of the November 1975, parent meeting; an interpretation of the school's most recent needs assessment; and a summary of the appropriate classroom observation and planbook findings over the past few years.

2.2.3 Program Needs

The identification of program needs was an imposing task. Although school personnel had often considered needs, the prior investigations were not generally as thorough as the program development required. It was during the examination of needs that participants began to express concern for the effect of the program development activities on their classroom responsibilities. The application of the previously described released time program and extension of services strategies tended to satisfy needs in that area. Further, the effect of the above provisions served as a motivational force throughout the staff and the practicum effort. Following the implementation of the program development activities, various members of the teaching staff also expressed concern for the completion potential of the program efforts. As the various provisions for supporting the activities of participants gained visibility, however, the doubts were replaced by more constructive intents. Finally, the optimism with which staff members viewed the project was evidenced by a desired increase in unsolicited suggestions, strategies, materials, and offers of assistance that was sustained as support throughout the practicum effort.

Activities to identify the program needs included examinations of the strengths and weaknesses of the existing program, the effect of the program on the student population, state and district guidelines, reactions from parents and teachers, the critical competitors, and the literature. Finally, the various attributes of the critical competitors were compared to the identified needs. In addition, the rejections were substantiated. In short, the participants' efforts resulted not only in the identification of needs but, also, in a general description of the desired program and the process of program development (see figure 2).

2.2.4 Program Objectives

During the early 1970's, the State of Florida Department of Education generated sets of objectives with matching evaluative criteria by utilizing as guidelines the implications of state specifications, national curriculum projects, and the content of state adopted textbooks. Numerous quantities of the objectives were presented in the Florida Catalog of Science Objectives. Teachers generally found the catalogs too cumbersome for classroom adaptation. Likewise, the participants required an inordinate amount of interpretive support before comprehension was complete and program development activities could begin. The task was to divide the materials into grade level sets. The reorganization activities were initiated only a short time when participants realized the impact of the quantity of materials even when divided into seven grade level groupings. Participants acted to limit the selection of objectives by ascertaining the importance of each to the grade level achievements. This task, although somewhat more complicated than the first, was, ultimately, the wiser course of action. It was necessary to reassess the data on the critical competitors and the work of others in order to establish criteria for the selection of some and elimination of other objectives.

In December 1976, after a majority of the program components were generated, the appropriateness of the selection and organization of the program objectives was reexamined. Opportunities for a comparative analysis were provided by the acquisition of the products of efforts by specialists from another of the district's six geographic areas. Although the efforts were limited to the reorganization of the state's objectives, the district's science consultant anticipated the benefits that could be mutually derived from such shared information and disseminated the products to the local school site. The analysis revealed that the main differences were in the designation of objectives at the higher grade levels. Participants at the local school site had included more advanced materials for upper grade students. In addition, local participants had extended the content beyond that of the state adopted textbooks in such areas as the marine sciences and the earth-space sciences. The differences were considered a reflection of the needs of the school's particular student population. Consideration was given to the intervention of this new product by implementing the appropriate reevaluation and revision processes.

Grade level meetings were established for the dissemination and introduction of the component. Thus, the program objectives were utilized by teachers as a framework for instruction.

2.2.5 Learning Activities

An examination of the program needs revealed that some program strategies should be provided for exclusive grade level use. The teaching staff further specified the needs by requesting eight of the exclusive learning activities for each grade level. In addition, the activities were to appropriately relate to the newly generated sets of objectives. The participants determined that it was advisable to include for the various grade levels at least one related activity in each of the three main content classifications. Consequently, although consideration was given to the inclusion of learning activities to represent each of the physical, biological, and earth-space sciences categories; the selection process was primarily influenced by the importance of the activities to the teaching/learning situation.

Learning activities were collected from the teaching staff and from other school sites. After an overview of the materials, the appropriate grade levels and objectives were designated for each. Certain of the activities were not considered because of concerns in such areas as the implications of the copyright law and the relationship to the program objectives.

As the learning activities were collected and examined, the participants grew to realize the value of the state's individualized teacher education modules. The module materials provided needed support to participants in the process of generating activities to supplement the collected materials and of designing a consistent format for presenting the component activities.

After the learning activities were designated for each grade level, members of the teaching staff reviewed the component. The appropriate revisions were provided, and trial periods were planned.

Materials were required for the implementation of the trial periods. An examination of the materials specified in the activities resulted in the realization that nearly all were described in the recent materials' inventory and available at the local school site. Consequently, participants reconsidered the learning activities to determine if the availability of materials had influenced the selection process. Consistently, the designated activities were included because of the implications of the teaching/learning situation. Volunteer parents and participants cooperatively located and organized the materials by grade level as requested. The trial periods indicated the need for certain revisions. Finally, science teachers were provided with the exclusive grade level activities and the inservice training necessary for implementation.

2.2.6 Other Resources

Consideration was given to the use of other available resources as components of the program development. Members of the steering committee reviewed the various state adopted textbooks and other critical competitors. In addition, the science dimension of the Dade County Public Schools Early Childhood Curriculum was provided for teachers of kindergarten, first, and second grades.

The institutionalizing of the recent basic skills program had been accompanied by provisions for the use of various resources to supplement the achievement of the program's objectives. The implications of these efforts were utilized to design a format for communicating the location of other materials related to the program's objectives.

The keycoded materials included two state adopted textbooks, two sets of teachers' guides to science activities, and the Early Childhood Curriculum (see figure 3).

The resource supplement provided science teachers with guidance in selecting materials related to the objectives of the program.

2.2.7 Introduction, Implementation, and Continuation

Plans for the introduction and implementation of the program were generated and intermittently applied as indicated by the steering committee progress. Community members were informed of the program's progress in the process of reviewing the various components and by the dissemination of the information to individuals and at Citizens' Advisory Board meetings.

In addition, school personnel were provided with reviews of the progress and the introduction of various components at staff meetings.

As the program activities accelerated to include the implementation of such strategies as trial periods and revisions, introduction into the system, and continuation; community members and school personnel external to the steering committee were involved to a greater degree. This involvement served two purposes. (1) Although program responsibilities were increasing, it was realistic to assume the accomplishments because of the extended personnel involvement. (2) The installation of the program was facilitated because those who were required to implement were involved in the development and in the evaluation of the program.

In developing and implementing the continuation plans, the ongoing participation of a steering committee was required. Although the maintenance of materials was not an issue in the implementation of the generated program, it was projected that future concerns could be related to the maintenance of materials. Therefore, steering committee plans included a periodic reevaluation of the program; provisions for the introduction of new resources, support of existing teachers, and the installation of teachers new to the system; and strategies for reviewing the effectiveness of the steering committee activities.

2.2.8 Evaluation

Formative and summative evaluation strategies were included as an integral part of the program development activities. Further, the results were utilized as the bases for decision making.

The implementation of the evaluative processes reconfirmed the benefits of a representative-type steering committee membership. Since the teacher participants were also grade level representatives, the dissemination and collection of materials and data were facilitated. In addition, the trial period and revision processes were easily implemented within the framework of a representative group because of the increased potential for the decentralization of responsibilities. Finally, the steering committee activities were supported by a structure for evaluation that considered the importance of adaptability by providing for the recycling of the processes as needed (see figure 5).

The evaluation component also required the use of various instruments and procedures. For example, the science section of the Florida Statewide Assessment Program was utilized to describe the experimental and control group results. The assessment program was initiated in schools throughout the State of Florida during the 1971-72 school year. The objective-referenced items of the assessment provided data to determine whether or not individual students had achieved the skill specified in the objective. The basic skills of reading, writing, and mathematics were also assessed. The science section of the test was designed for sixth grade students. However, since the test was designed to assess achievement on only the minimum objectives, the items were generally somewhat easier than the grade level standards.

An examination of the assessment program revealed a number of factors that influenced the selection of the Florida test. Concerns were often expressed for the influence on the results of locally generated products. The concerns were based on the assumption of prior knowledge of the product and its objectives. The implications of the concerns, with their allegations of biased results, led many to consider viable alternatives that were external to the local or state educational system. However, the state had provided for the security of the documents. It was difficult to obtain the documents even for this study. In addition, although two forms of the science section had been generated, the limitations of state funds had resulted in the elimination of the section from the test battery after only the one year of implementation. In short, the similarities that might exist between the substance of the test and the program activities would be attributed to chance. In addition, the content of the test could be adapted for use at the fifth and sixth grade levels. Finally, the two forms of the test and its machine scorable answer sheets were utilized in the process of pretesting and posttesting students.

The evaluation strategies also required the use of such instruments as a checklist, observable criteria, and problem solving situations.

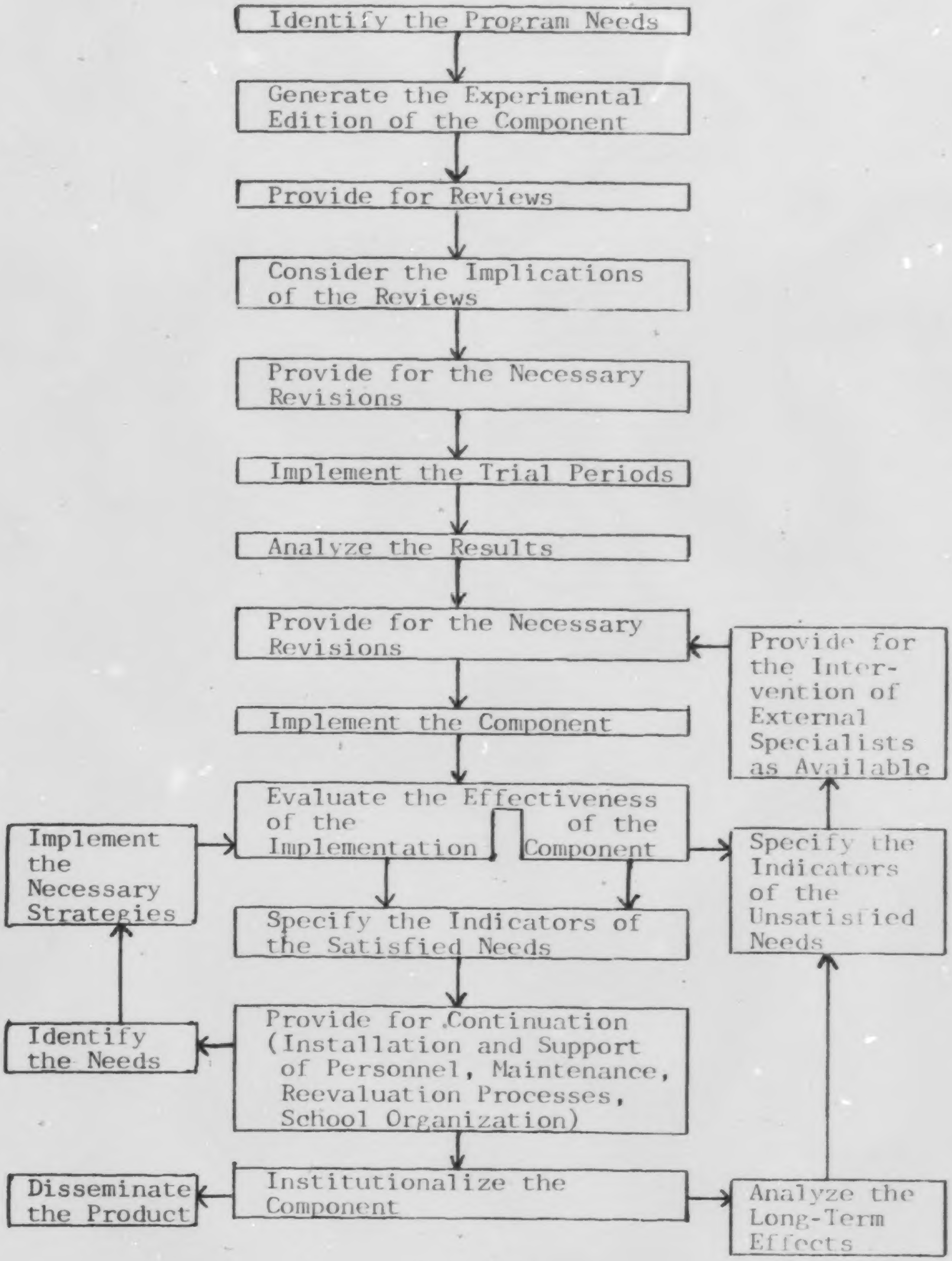
Identify the Program Needs
Generate the Experimental Edition of the Component
Provide for Reviews
Consider the Implications of the Reviews
Provide for the Necessary Revisions
Implement the Trial Periods
Analyze the Results
Provide for the Necessary Revisions
Provide for the Intervention of External Specialists as Available
Implement the Component
Evaluate the Effectiveness of the Implementation of the Component
Implement the Necessary Strategies
Specify the Indicators of the Unsatisfied Needs
Specify the Indicators of the Satisfied Needs
Identify the Needs
Provide for Continuation (Installation and Support of Personnel, Maintenance, Reevaluation Processes, School Organization)
Disseminate the Product
Institutionalize the Component
Analyze the Long-Term Effects

Figure 5

VISUALIZING THE EVALUATIVE PROCESSES

Thus, the components of the science program were developed and implemented at the local school site. The next chapter includes a description of the results.

CHAPTER 3

RESULTS

This chapter focuses on the results of the practicum. First, the specifications of each practicum objective are compared to the data on the actual accomplishments. Next, the results are interpreted. Finally, the dissemination process and the follow-up activities are described.

3.1 THE DATA

3.1.1 Objective Achievement

Terminal objectives in four major areas were structured to describe the desired outcomes. The four terminal objectives were achieved during the implementation of the practicum.

(1a) One hundred percent, rather than the predicted 95 percent of the local school site student scores, did show gains in the number of correct responses on the science section of the Florida Statewide Assessment Program (see table 1).

(1b) Local school site scores were predicted to show the greater correct response increase in 70 percent of the pairs. Actually, the greater increase was indicated by local school site scores in 72 percent of the pairs (see tables 2 and 3). This calculation included the pairs with zero differences as a part of the subset of pairs for which local school site scores were not the higher of the two.

GRADE 5 RAW SCORES			GRADE 6 RAW SCORES		
Ref. Nos.	Pretest	Posttest	Ref. Nos.	Pretest	Posttest
1	19	21	1	8	16
2	7	10	2	15	21
3	13	18	3	29	30
4	3	7	4	19	25
5	11	21	5	10	12
6	15	25	6	7	10
7	15	23	7	5	9
8	13	15	8	26	28
9	13	21	9	6	7
10	24	27	10	24	26
11	16	26	11	23	27
12	6	11	12	16	22
13	19	22	13	10	15
14	7	13	14	14	15
15	7	9	15	17	23
16	6	15	16	20	21
17	15	20	17	16	19
18	9	11	18	14	18
19	22	26	19	26	29
20	14	16	20	9	15
21	14	16	21	21	25
22	8	12	22	13	19
23	6	7	23	5	7
24	6	13	24	18	23
25	7	14	25	9	14
26	5	11	26	27	28
27	7	11	27	17	22
28	7	15	28	18	19
29	15	19	29	6	12
30	9	14	30	26	28
31	6	12	31	7	14
32	14	21	32	11	19
33	23	24	33	18	23
34	5	7			
35	17	22			
36	15	20			

Table 1

FLORIDA STATEWIDE ASSESSMENT PROGRAM, SCIENCE SECTION -

PRE/POST TEST RESULTS FOR THE EXPERIMENTAL GROUP

GRADE 5 RAW SCORES			GRADE 6 RAW SCORES		
Ref. Nos.	Pretest	Posttest	Ref. Nos.	Pretest	Posttest
1	11	15	1	25	25
2	23	23	2	27	28
3	14	17	3	19	22
4	5	10	4	17	15
5	7	15	5	25	27
6	5	12	6	15	16
7	10	11	7	14	17
8	6	8	8	3	5
9	8	7	9	17	20
10	9	13	10	17	17
11	13	17	11	23	24
12	2	5	12	15	16
13	12	18	13	23	25
14	8	10	14	6	7
15	12	15	15	11	17
16	5	9	16	6	10
17	11	12	17	18	20
18	12	17	18	18	17
19	10	9	19	26	25
20	7	11	20	12	13
21	7	9	21	19	23
22	15	23	22	12	15
23	18	19	23	21	22
24	9	10	24	21	20
25	19	20	25	16	18
26	17	15	26	6	10
27	2	5	27	13	15
28	7	13	28	22	23
29	20	20	29	27	29
30	16	19	30	8	15
31	9	14	31	20	21
32	6	9			

Table 2

FLORIDA STATEWIDE ASSESSMENT PROGRAM, SCIENCE SECTION - PRE/POST TEST RESULTS FOR THE CONTROL GROUP

GRADE 5 PAIRS N = 22 E = Experimental Group				GRADE 6 PAIRS N = 26 C = Control Group			
Paired Ref. Nos.	Pretest	Posttest	E-C=D	Paired Ref. Nos.	Pretest	Posttest	E-C=D
33E	23	24		8E	26	28	
2C	23	23	+1	1C	25	25	+2
1E	19	21		19E	26	29	
25C	19	20	+1	19C	26	25	+4
13E	19	22		26E	27	28	
29C	20	20	+3	2C	27	29	0
11E	16	26		30E	26	28	
30C	16	19	+7	29C	27	29	0
35E	17	22		10E	24	26	
26C	17	15	+7	13C	23	25	0
17E	15	20		11E	23	27	
22C	15	23	-3	11C	23	24	+3
9E	13	21		21E	21	25	
3C	14	17	+5	23C	21	22	+3
8E	13	15		16E	20	21	
11C	13	17	-2	31C	20	21	0
5E	11	21		4E	19	25	
17C	11	12	+9	3C	19	22	+3
18E	9	11		28E	18	19	
10C	9	13	-2	18C	18	17	+2
30E	9	14		24E	18	23	
24C	9	10	+4	17C	18	20	+3
22E	8	12		15E	17	23	
9C	8	7	+5	10C	17	20	+3
2E	7	10		27E	17	22	
5C	7	15	-5	9C	17	20	+2
15E	7	9		17E	16	19	
20C	7	11	-2	4C	17	15	+5
25E	7	14		12E	16	22	
28C	7	13	+1	25C	16	18	+4
28E	7	15		2E	15	21	
21C	7	9	+6	6C	15	16	+5
16E	6	15		18E	14	18	
32C	6	9	+6	12C	15	16	+3
12E	6	11		14E	14	15	
8C	6	8	+3	7C	14	17	-2
26E	5	11		22E	13	19	
4C	5	10	+1	27C	13	15	+4

(continued)

Table 3

A COMPARISON OF POSTTEST AND PRETEST RESULTS FOR THE PAIRED EXPERIMENTAL AND CONTROL GROUPS

Table 3 - Continued

GRADE 5 PAIRS N = 22 E = Experimental Group				GRADE 6 PAIRS N = 26 C = Control Group			
Paired Ref. Nos.	Pretest	Posttest	E-C=D	Paired Ref. Nos.	Pretest	Posttest	E-C=D
34E	5	7		32E	11	19	
6C	5	12	-5	15C	11	17	+2
24E	6	13		5E	10	12	
16C	5	9	+3	20C	12	13	+1
4E	3	7		13E	10	15	
12C	2	5	+1	22C	12	15	+2
				1E	8	16	
				30C	8	15	+1
				9E	6	7	
				14C	6	7	0
				29E	6	12	
				16C	6	10	+2
				7E	5	9	
				26C	6	10	0

-Fifth Grade Results: 72 percent of the local school site paired scores indicated greater increases than those of the control group paired scores.

-Sixth Grade Results: 73 percent of the local school site paired scores indicated greater increases than those of the control group paired scores.

Further data were provided by considering the extent of the differences between the raw scores of the paired experimental and control groups (E-C=D). At the fifth grade level, the average paired score difference was 1.5 points higher for the experimental group. Similarly, at the sixth grade level, the average paired score difference was 1.8 points higher for the experimental group.

Since the experimental and control group pairs had been formulated by considering pretest score similarities as indicators of achievement potential, the paired posttest results were utilized to determine significance.

An examination of the criterion-objective tests of the Florida Statewide Assessment Program revealed a design that departed appreciably from distribution normality. The desirable result was a negative skew. Consequently, a measure of skewness was applied to the experimental groups' pre/post test results (see table 4). Only the distribution of the sixth grade posttest data was indicative of the intended skewness.

MOMENTS ABOUT THE MEAN	MEAN $\bar{X}$	2nd MOMENT M_2	3rd MOMENT M_3	ORIGIN g_1	SKEW
Experimental Gr. 5 Pretest	11.33	2.56	24.576	6	positive
Experimental Gr. 5 Posttest	16.5	.3403	1.1909	5.9990	positive
Experimental Gr. 6 Pretest	15.36	6.6	97.44	5.75	positive
Experimental Gr. 6 Posttest	19.54	2.0976	-17.4524	-2.7068	negative

Table 4

SKEWNESS OF THE DISTRIBUTIONS OF

PRE/POST TEST RESULTS OF THE EXPERIMENTAL GROUP

The significance of the results was determined by the use of the nonparametric sign test. The plus and minus descriptors of the paired differences (E-C=D) in table 3 yielded some pertinent data. In this instance, zero differences were discarded.

At the fifth grade level, the probability of obtaining 16 or more of the 22 positive paired score differences was .026. In 16 of the pairs, the experimental increase was the higher of the two. These differences were significant at the .05 level.

At the sixth grade level, the probability of obtaining 19 or more of the 20 plus scores was .00002. In 19 of the pairs, the experimental increase was the higher of the two. Thus, the comparison clearly showed that the experimental group differences did not occur by chance. The null hypothesis was rejected.

(2) Objective number two specified that two out of the three students questioned in classrooms effected by program intervention would respond to a problem situation by applying components of the scientific method in the solution process. The designated number of students did appropriately utilize the various components of the scientific method in response to questions by an external observer. A form was designed to facilitate the retrieval of information and the determination of appropriateness (see figure 6). Four out of the six components on the checklist were required for a satisfactory response.

STUDENT'S NAME______________________________DATE____________

TEACHER__________________________________OBSERVER__________

Brief Statement of the Problem Situation:

CHECKLIST OF COMPONENTS OF THE SCIENTIFIC METHOD:

_____Careful observation and/or consideration of the data and the materials.

_____Measurement of the materials and/or the alternatives for resolution.

_____Formulation of "hypotheses" based on the previous examinations of the data.

_____Designation of provisions for testing the hypotheses or theories.

_____Provisions for accurate reports of the results.

_____Evidence of logical thought processes.

COMMENTS:

4/6_____/6

Figure 6

CHECKLIST OF COMPONENTS OF THE SCIENTIFIC METHOD

(3a) As was specified in the objective, by the conclusion of the 1976-77 school year, the program objectives were utilized as a framework for instructional planning by 100 percent of the science teachers. Data for the satisfaction of this objective were collected by a periodic examination of planbooks and classroom observation records.

(3b) This objective predicted that by the conclusion of the 1976-77 school year, the program objectives, teaching strategies, and training suggestions would be utilized to supplement instruction by 75 percent of science teachers. By the conclusion of the 1976-77 school year, 11 of the 15 science teachers were utilizing the program components to supplement instruction. Examinations of planbooks and classroom observation records were the primary determiners.

It was interesting to note that three of the four teachers for whom there was no indication of the use of the teaching strategies and/or the training suggestions were participants in a different staff development activity at the local school site. Seventy-three percent of the science teachers were involved as specified. The objective was not fully achieved.

(3c) It was predicted that the average pretest to posttest increase in the number of correct responses by students of teachers with full program implementation would be greater than that of students of teachers with partial program implementation. Data collected from objective number four were applied to determine the status of each teacher's program implementation. The average increase of 4.4637 by students of teachers with full program implementation was greater than that of 2.8968 by students of teachers with partial program implementation.

(4) By the conclusion of the 1976-77 school year, 60 percent of science teachers were expected to demonstrate a satisfactory level of full program implementation. The level of teacher implementation was labeled "satisfactory" when each of the "Observable Criteria for the Implementation of the Science Program" was satisfied in a given classroom (see figure 7). By April 1977, 67 percent of science teachers were satisfactorily implementing the new program.

(5) As the practicum objectives had predicted, procedures did provide for the generation and implementation of the staff development component (see appendices A and B). The procedures were utilized to guide activities throughout the practicum implementation.

OBSERVABLE CRITERIA IN SCIENCE

N = 11

		PERCENTAGE OF TEACHER IMPLEMENTATION
1.	The program objectives are utilized as a framework for instructional planning.	100
2.	The program's teaching strategies are utilized to supplement instruction.	91
3.	A variety of resources are provided for teacher and student use in achieving the program objectives.	81
4.	A variety of approaches to learning are indicated in the instructional plans.	81
5.	The instructional program emphasizes the development of the learning processes.	91
6.	Students utilize the scientific method in the solution to problems (see the designated form).	100
7.	The teacher demonstrates an awareness of the procedures provided for the support, continuation, and maintenance of the program.	91
	PERCENTAGE OF TEACHERS IN FULL COMPLIANCE (67 percent of the total number of science teachers)	91

Observer's Signature Date

Figure 7

OBSERVABLE CRITERIA FOR THE IMPLEMENTATION OF THE SCIENCE PROGRAM

(6) The designated procedures were applied, as predicted, for generating the initial program components and guiding the practicum processes (see appendix A and figure 5).

(7) The designated procedures were applied for the support of existing teachers and the installation of new teachers (see appendices A and B).

(8) Procedures were provided for the maintenance and continuation of the program (see appendix A).

(9a) As predicted, the appropriate school personnel did organize the program's objectives and evaluative criteria (see appendix C).

(9b) As predicted, the appropriate school personnel did develop eight teaching strategies for exclusive use at each grade level (see appendix C).

(9c) The appropriate materials were organized by school personnel and volunteer aides.

(10a) School personnel did provide for trial periods and revisions as needed (see figure 5).

(10b) School personnel, community members, and external specialists did evaluate the program (see figure 5).

(11a) The staff development module was generated, scheduled, and supported by a request for in-service credit by the writer.

(11b) The participants did provide for the introduction and support of the program (see appendices A and B).

(12) The practicum processes did provide for the periodic reevaluation and revision procedures and the continuation plans.

(13) The appropriate curriculum bulletin was disseminated by the writer (see appendix D).

(14) After the evaluation of the program, the writer did provide and introduce a cross-reference for related materials and a format revision for the activities (see appendix A).

(15) A staff development component design was generated, introduced, and disseminated by the writer (see appendices B and D).

(16) A procedures manual for school based management of program development was generated and disseminated by the writer (see appendices C and D).

3.1.2 Summary of the Accomplishments

A graphic summary of the extent of objective achievement is included in figure 8, "Visualizing the Outcomes."

3.1.3 Analysis of the Resources

The performance of the practicum activities required fewer funds than had been anticipated. The learning activities generated as a component of the program utilized, for the most part, existing school materials. With the exception of such consumable items as litmus paper and various chemicals, expenditures in that area were not indicated. Even the process of duplicating the materials involved few direct costs.

Direct Costs:

Replacement of Consumable Materials	$ 75
Duplicating Materials (excluding the use of facilities, existing materials, and clerical assistance)	$112
TOTAL	$187

Continuation Costs (per year) $80

OBJECTIVES	FULLY ACHIEVED	NOT ACHIEVED
TERMINAL		
1a. Increase local school site posttest responses.	X	
1b. Higher increase of the pair by local school site students.	X	
2. Application of the scientific method by students.	X	
3a. Utilization of program objectives.	X	
3b. Utilization of training suggestions and teaching strategies.		X
3c. Higher test results for fully implementing teachers.	X	
4. Satisfactory level of implementation.	X	
MANAGEMENT		
5. Guidelines for staff development.	X	
6. Procedures for initiating, reevaluating, revising activities.	X	
7. Guidelines for supporting and installing teachers.	X	
8. Procedures for maintaining and continuing the program.	X	
PROCESS		
9a. Organize objectives.	X	
9b. Generate teaching strategies.	X	
9c. Organize materials.	X	
10a. Implement trial periods & revisions.	X	
10b. Implement evaluative procedures.	X	
11a. Implement staff development.	X	
11b. Provide for introduction and support.	X	
12. Implement continuation procedures.	X	
PRODUCT		
13. Curriculum bulletin.	X	
14. Resource supplement.	X	
15. Staff development component.	X	
16. Procedures manual.	X	

Figure 8

VISUALIZING THE OUTCOMES

Indirect costs were primarily temporal. That is, the time and efforts of the involved persons were rerouted. Even though the released time and extended services program was instituted, the program development continued to require much of the participants' available time. In addition, the revision processes placed demands on the school's secretarial staff and volunteer assistants that could not be satisfied by the existing resources. Consequently, participants were required to intermittently assume clerical roles. However, the situation seemed to result in further refinements to the local decision making skills. Subsequent to such activities, participants indicated that they were more discriminating in their selection processes. An examination of this and other side effects of the temporal concerns revealed no detrimental results. Rather, certain of the generic skills of the program development were being utilized to advantage throughout the school.

Consideration was also given to the "Opportunity Costs" of the program development activities. Within the LEA, all members of the teaching staff had attained a satisfactory level of implementation of the district's recently instituted basic skills programs. Teachers had already been provided with staff development opportunities in these areas. However, opportunities to further refine the basic skills program and/or tutor students in the basic skills during free time were somewhat depressed for the main participants in the program development. Participants questioned the feasibility of an "Opportunity Cost" related to the use of discretionary time because of their past observations regarding these activities. In short, the "Opportunity Costs" implied only minimal risks when compared to the program development needs and the benefits to the school that resulted from the participants' sense of mission for program development.

3.2 THE INTERPRETATION

In this section, the examination of data is extended to include an interpretation of the objective achievement, the omissions, and the problems. In addition, the results are further analyzed by comparing the initial practicum concerns to the behavioral changes in the local educational environment.

The specified evaluative criteria of the objectives were utilized as determinants of the extent of objective achievement. Consequently, it was concluded that, during the development and implementation of the practicum effort, a majority of the practicum objectives were fully achieved.

For example, data collected prior to the program intervention were specified as components in the evaluation of some of the terminal objectives. In each of these instances, the results were somewhat more favorable than expected.

Similarly, for one of the terminal objectives, control group scores were paired with those of local school site students. Again, the results were better than the initial expectations. Although, in relation to the control group, the local school site scores showed greater gains, seven of the eight frequency distributions were positively skewed. These distributions were in contrast to the tests' validated negative skewness (see table 4). This disparity in results clearly indicated that both the experimental and control groups encountered more difficulty in responding to the test items of the Florida Statewide Assessment Program, Science Section, than that of the tests' validation population. The implications of this data reinforced the importance of the practicum effort. In addition, the differences between the paired experimental and control group test results were significant. The higher gains by the experimental group could be attributed to the program intervention.

It was also interesting to note that the extent of program implementation somewhat affected the results. The data on students of partially and fully implementing teachers described the advantages of the full implementation. However, a further examination of the results revealed the influence of other variables. Over a period of years, the annual evaluations of the fully implementing teachers were consistently higher than those of the partially implementing teachers. Similarly, dialogs with community members and other school personnel also implied that the teachers with full implementation were generally the more successful teachers. Consequently, the data on the extent of program implementation was interpreted as an indicator of the activities of successful teachers rather than as a total result of the implementation status.

The procedures and processes that were utilized to generate and implement the program development were very effective. The full achievement that was realized for the management and process objectives largely resulted from their high responsiveness to the needs and to the data. However, there were also other influences. A further analysis of the data revealed a high positive correlation between the willingness with which school personnel embraced such localized decision making as that of the practicum activities and the recency of increased demands on the schools of Federal, state, and district mandates. In short, the timing of the implementation of the practicum appropriately encouraged its success.

Similarly, the product objectives were fully achieved for school use and for purposes of dissemination.

One of the objectives was not achieved as planned. Shortly after the initiation of the practicum activities, personnel from the central office urged primary teachers throughout the district to participate in a new basic skills staff development program for early childhood education. Participants were provided with the materials and training necessary to implement the program structure. School based management and personnel were required by the component design. Prior to the participation, a number of teachers had piloted the program without the assistance of the staff development component. The materials were greeted with enthusiasm. However, participants soon realized the effect of the theoretical and philosophical emphasis of the staff development component. The time required for completion was much greater than the participants had anticipated. Consequently, the local school site program development was fully implemented by fewer than the expected number of staff members. The implications of the early childhood staff development program served to influence plans at the local school site. The negative influence of the early childhood training module on the program's implementation was analyzed and considered in plans for the introduction of the local school site science program.

The few problems that were encountered during the implementation of the practicum implicated, mainly, temporal concerns and their effect on the functioning of the group process in decision making situations. For example, one of the participants consistently attempted to act and encourage others to act submissively when presented with decision making differences. In such situations, issues were stated clearly and dealt with as facts. In addition, variant opinions were respected and efforts directed toward consensus. By the conclusion of the practicum effort, communications within the group were efficiently directed toward achieving the desired result.

The program development was decelerated by the limitations of the clerical services. Although volunteer assistance was elicited, the effort was inconsistent and not always dependable. Other decelerating factors included the time demands of the early childhood staff development module.

The program was accelerated by the response to the temporal concerns of the participants of the released time program. Other accelerating factors included the teacher-initiated requests for the program development and the sense of mission of the participants.

At the conclusion of the practicum effort, the results of the program development were analyzed by comparing the initial concerns to the program development changes.

The analysis revealed that teachers more effectively provided for learning in science. In addition, a continuous, sequential curricular structure was utilized throughout the grades. Parents and teachers indicated their appreciation for the program improvements.

The issue of program structure had initially been described as an area of concern. Needs in this area were evidenced by each segment of the involved population. Although parents, students, and teachers, alike, had stipulated the importance of a nonvacillating, continuous sequence of learning, the teacher group perceived still a different kind of concern. Teachers consistently described the minimum support required for the effective implementation of an instructional program. Realistic implementation efforts included such components as organized, schoolwide objectives; evaluative criteria; selected teaching strategies; implications for the use of related materials; and an organizational setting that provided for the maintenance, support, installation, and continuation of the program. Thus, the minimum components were developed and learning was facilitated.

The initial concerns of the practicum had also implicated the teaching strategies. Concerns were expressed for the effect on learning of the commonly employed method of proceeding through the textbook by requiring students to write responses to textbook questions. One of the criteria for selecting the teaching strategies of the new program was to provide teachers with varying examples of approaches to learning. Similarly, the introduction of the program appropriately emphasized the importance of these approaches. This emphasis was also designed to satisfy the needs of teachers for program changes that were accompanied by implementation options. Subsequently, teachers reported that the science program was effectively adapted for use within a variety of student and teacher situations. Similarly, an examination of teacher planbooks and classroom observation records indicated that teachers were appropriately applying a greater variety of approaches to learning.

Prior to the implementation of the program development activities, needs had surrounded the increasing number of mandates and mandated programs. Consequently, a growing number of teachers were acting with subliminal and sometimes overt predetermination to reject the encroachment on the schools of further centralized change factors. The implementation of the school based management system responded in several ways. The school level changes were easily introduced and accepted since those who were required to implement planned for the changes. In addition, after the implementation of the program development, mandated programs seemed to be more readily accepted at the local school site. Members of the steering committee described this phenomenon by expressing their respect for the effort and expertise that such projects demanded.

Although the new program was readily accepted, the effects did not conclude there. Generic decision making skills had been developed and were utilized in classroom and other school situations. Teachers also generated other related activities and requested supplementary science materials. Thus, school personnel had affected program improvements and developed skills for future use.

3.3 THE DISSEMINATION

A bulletin entitled Science Education: Elementary School Objectives, Selected Activities, and Assessment Items was disseminated to administrators at five school sites. The bulletin was accompanied by a manual entitled Procedures for Implementing School Based Management of Program Development (see appendices A and C). The manual was the result of the procedural suggestions of the school personnel who participated in the implementation of the school based management system. Prior to the implementation of the program development activities, a staff development component design was submitted for inclusion in the Dade County Public Schools Master Plan for Staff Development (see appendix B). Finally, the procedures manual, science bulletin, and staff development component design were disseminated to the area staff director for curriculum, the Dade County Public Schools Science Consultant, the Dade County Public Schools Social Studies Consultant, and the State of Florida Department of Education.

CHAPTER 4

CONCLUSIONS

Before the initiation of the practicum effort, needs surrounded the school's science program. Over a period of years, the resistance sometimes associated with school changes had been strengthened by program transiency and external mandates. The success of plans for program improvement was also **affected** by declining central office support. The involved persons grew to realize that, within the existing school structure, it was unrealistic to assume the satisfaction of the various program needs in the near future. Thus, the origin of a growing number of curricular, pupil population, and school personnel problems implicated weaknesses in the school's provisions for generating and implementing program improvements.

The practicum effort resulted in the satisfaction of many of the identified needs. Further, some of the accomplishments were equal to or greater than the predicted outcome indicators of the specified evaluative criteria of the practicum. Finally, the procedural and behavioral changes of the involved persons reflected the appropriateness of the revised program and the effectiveness of the practicum results.

The following recommended changes were generated for use in further practicum applications.

(1) One of the prerequisites for initiating practicum activities should be the acquisition of clerical support in excess of the predicted needs.

(2) The instrument utilized to describe the student achievements of the practicum effort should be changed in order to provide test data on more of what students do know.

The results of the practicum implied that further study should be conducted to provide answers to questions in the following areas.

(1) What are the districtwide implications of programs developed at the school level?

(2) What is the correlation between the effectiveness of school level program development activities and the success at the school level of subsequent mandated programs?

The seriate statements that follow were concluded from the data on the practicum effort, its results, and its implications.

(1) The intervention of a growing number of external mandates served to increase local needs for autonomy and, thus, to encourage participation in school level decision making activities.

(2) In major program development activities, voluntary participants who were directly effected by the related needs generally demonstrated the sense of mission required to sustain the project to completion.

(3) The small size and representative characteristics of the steering committee effectively facilitated the practicum processes.

(4) The productive involvement of school level personnel in decision making activities tended to result in heightened teacher initiative in other areas.

(5) The practicum resulted in a greater than previous chance to affect the desired program improvements because those who were required to implement were also directly involved in planning for the changes.

(6) Acceptance into the system was encouraged by the program's provisions for flexible classroom adaptation.

(7) The teaching/learning situation benefited from the implementation of the practicum's consistent, sequential curricular structure and its complement of procedures for continuation.

(8) Teachers who developed generic decision making skills in the process of effecting program improvements generally applied the skills to further enhance their individual classroom situations.

(9) The practicum effort was found to be appropriate for use by curriculum consultants, supervisors, administrators, and others interested in effecting school level program improvements.

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APPENDIX A

PROCEDURES FOR IMPLEMENTING SCHOOL BASED MANAGEMENT OF PROGRAM DEVELOPMENT

PROCEDURES FOR IMPLEMENTING SCHOOL BASED MANAGEMENT OF PROGRAM DEVELOPMENT

Miami, Florida
1977

PREFACE

This manual is an outgrowth of the procedural suggestions of school personnel who have participated in the process of implementing school based management of program development.

Even when local schools are provided with the full and desirable extent of strong, centralized curricular support, wide variations in program needs exist at the local level. Consequently, effective guidelines for the satisfaction of such divergent needs are required to be adaptable for use at different levels and within various subject areas and circumstances. This manual responds to these needs by providing a generic model of procedures to guide program improvement efforts at the local level.

The procedural suggestions in the manual are presented in six sequential component parts. A "Program Development Checklist" provides the necessary directions for matching the status of the existing program to the appropriate component materials and, thus, for proceeding through the manual.

This manual was prepared by the author as a part of the degree requirements of the National Ed. D. Program for Educational Leaders, Nova University.

OBJECTIVES

GENERAL OBJECTIVES

1. Increase program effectiveness and local acceptance of change by developing the generic school level decision making skills associated with program generation, introduction, and continuation.
2. Develop a program that provides local and state responsiveness, continuity, sequence, and consistency for students in a particular subject area(s) and at a designated grade level(s).

SPECIFIC OBJECTIVES

1. Generate an organizational plan to guide participant activities in school based management of program development.
2. Identify program needs.
3. Generate and/or select and organize objectives and evaluative criteria by sequence and level as needed.
4. Identify and/or develop the activities, materials, strategies, and other resources needed to appropriately support the teaching/learning situation.
5. Develop plans for the introduction, implementation, and continuation of the program.
6. Establish formative and summative evaluation procedures.

PROGRAM DEVELOPMENT CHECKLIST

Participant	Subject Area	Level(s)	Date

Directions: Proceed sequentially through the six statements by checking either "Yes" or "No" in response to the status of your particular program. Each of the statements is further described by the procedures on the component page of the same number as the statement.

	YES	NO
1. Participants' activities are guided by an organizational plan for program development.	If yes, go to statement #2.	If no, go to component # 1.
2. Program needs are specified.	If yes, go to statement #3.	If no, go to component # 2.
3. Objectives and evaluative criteria are appropriate for use and organized by learning sequence &/or level as needed.	If yes, go to statement #4.	If no, go to component #3.
4. Learning activities are appropriately provided.	If yes, go to statement #5.	If no, go to component #4.
5. Plans are provided for effective program implementation.	If yes, go to statement #6.	If no, go to component #5.
6. Formative and summative evaluation procedures are established.	If yes, disseminate product.	If no, go to component #6.

COMPONENT 1

OBJECTIVE:

Generate an organizational plan to guide participant activities in school based management of program development.

PROCEDURES:

1.1 Obtain the necessary approvals for proceeding with program development activities.

1.2 Organize a 5-12 member steering committee of representative teaching and administrative personnel to coordinate program development activities.

1.3 Contact the appropriate central office and other school site personnel in order to ascertain the existence of recent or current related efforts for program development.

1.4 Compare the strengths and weaknesses of the existing school program with other programs, research, environmental and resource circumstances, and other school needs to determine the advisability of proceeding with the indicated program development.

1.5 Generate plans that contain such specific and necessary procedures for the implementation of program development as meeting times, projected calendar to completion, description of activities, participant roles, personnel and other resources needed, implementation strategies, and provisions for contingencies.

Go back to statement #1 on the "Program Development Checklist."

COMPONENT 2

OBJECTIVE:

Identify program needs.

PROCEDURES:

2.1 List the strengths and weaknesses of the existing program.

2.2 Describe the effect of the program on the student population.

2.3 Specify other environmental indicators of the need for program development (e.g., responsiveness to state guidelines, parent reactions, teacher reactions, materials inventory).

2.4 Compare the attributes of the existing program to those of other schools and commercial programs.

2.5 Analyze the implications of research.

2.6 List each identified need.

2.7 For each identified need, describe the desired observable effect of the intervention of the change strategies of program development.

Go back to statement #2 on the "Program Development Checklist."

COMPONENT 3

OBJECTIVE:

Generate and/or select and organize objectives and evaluative criteria by sequence and level as needed.

PROCEDURES:

3.1 If writing of objectives is required, utilize as a referent the following individualized teacher education module:

State of Florida Department of Education. Cluster II: Planning Skills for Teachers. Elizabeth A. Collins, Director. Module 1: Using Behavioral Objectives. Chipley, Florida: Panhandle Area Educational Cooperative, 1970.

3.2 Develop a set of objectives for program development utilizing the specifications of the previously identified needs.

3.3 Select and organize objectives by learning sequence and/or grade levels by utilizing the implications of research, data on the student population, and a variety of appropriate commercial materials as criteria in the process.

3.4 Request the assistance of an external specialist in the field to review the set of organized objectives.

3.5 Disseminate the objectives to the teaching staff for review.

3.6 Analyze the various reviews, consider other available data, and revise the objectives as appropriate.

3.7 Utilize volunteer and other resources in the process of duplicating the revised set of objectives.

3.8 Implement steering committee plans for reporting program development progress to the teaching staff.

Go back to statement #3 on the "Program Development Checklist."

COMPONENT 4

OBJECTIVE:

Identify and/or develop the activities, materials, strategies, and other resources needed to appropriately support the teaching/learning situation.

PROCEDURES:

4.1 Determine the extent of learning activities, materials, strategies, and other resources needed for successful implementation.

4.2 If learning activities are to be developed, utilize such referents as the following individualized teacher education modules:

State of Florida Department of Education.
Cluster II: Planning Skills for Teachers.
Module 2: Designing a Learning Activity.
Cluster: Middle School Generic Teaching Competencies
Module 10-B: Analyzing and Writing Curriculum Units.
Chipley, Florida: Panhandle Area Educational Cooperative, 1970.

4.3 If materials and other resources are to be indicated, utilize such referents as the following individualized teacher education modules:

State of Florida Department of Education.
Cluster II: Planning Skills for Teachers.
Module 5: Selecting Commercial Materials.
Cluster: Middle School English
Module V-1: Selecting and Utilizing Instructional Resources.
Chipley, Florida: Panhandle Area Educational Cooperative, 1970.

4.4 If strategies for the use of materials and other resources are to be considered, develop charts that indicate for each objective the appropriate related supplementary resources.

4.5 Develop plans for the organization and dissemination of materials and other resources related to the program.

4.6 Request the assistance of an external specialist in the field to review the generated materials.

4.7 Disseminate the program's materials to selected members of the teaching staff for review.

4.8 Analyze the various reviews, consider other available data, and revise the materials as appropriate.

4.9 Implement steering committee plans for reporting program development progress to the teaching staff.

Go back to statement #4 on the "Program Development Checklist."

COMPONENT 5

OBJECTIVE:

Develop plans for the introduction, implementation, and continuation of the program.

PROCEDURES:

5.1 Develop program introduction, implementation, and continuation plans that appropriately inform and involve school personnel and community members.

5.2 Prepare for program implementation by providing progress reports during the program development stage.

5.3 Prepare for program implementation by appropriately involving school personnel and community members in formative reviews of the generated materials and in trial period activities.

5.4 Develop plans for introduction into the system that specify such areas as staff development components; the roles and responsibilities of steering committee members, other school personnel, and community members; agenda items; and materials needed.

5.5 Develop procedures for monitoring and supporting the implementation process.

5.6 Provide for the installation of new personnel.

5.7 Develop plans for continuation that provide for such areas as the ongoing organization, maintenance, and acquisition of materials; the introduction of new materials and other program changes; the support of teaching and learning; and the procedures for responding to the implications of established evaluative procedures.

Go back to statement #5 on the "Program Development Checklist."

COMPONENT 6

OBJECTIVE:

Establish formative and summative evaluation procedures.

PROCEDURES:

6.1 Develop plans for periodic evaluations and revisions of the program.

6.2 Provide trial periods and formative evaluation procedures in the process of generating and revising the program.

6.3 Develop observable criteria for the determination of program effectiveness.

6.4 Compare the initial description of needs to the actual results of the program.

6.5 Examine the side-effects of the program.

6.6 Examine the effect of the program on other school needs.

6.7 Provide for an external evaluation of ongoing program activities and final results.

Go back to statement #6 on the "Program Development Checklist."

84/85

NOTES:

COMMENTS:

APPENDIX B

COMPONENT DESIGN FOR STAFF DEVELOPMENT: SCHOOL BASED MANAGEMENT OF PROGRAM DEVELOPMENT

COMPONENT DESIGN

FOR DEVELOPING A NEW STAFF DEVELOPMENT PROGRAM

Directions: Complete this component design if you are requesting approval of a new staff development program which is not presently included in the Dade County Master Plan for inservice teacher education or one which represents major revisions of an existing approved component. Forward to Office of Staff Development, A-1, Room 310, L. H. E. C., at least six weeks prior to expected starting date.

NAME OF INITIATOR: ______________________ TITLE: ____________

LOCATION OF INITIATOR: ______________ PHONE: ______ DATE OF REQUEST: __________

APPROVED: AREA OR DIVISION DIRECTOR: ______________________ SIGNATURE AND TITLE __________ DATE

APPROVED: APPROPRIATE CENTRAL OFFICE CONSULTANT: ______________________ SIGNATURE AND TITLE __________ DATE

- -

As a staff development program which has not previously been approved for the Dade County Master Plan, the component must be submitted to the Florida Department of Education according to the following procedures stated in the "Criteria for Designing, Developing and Approving a District Master Plan for Inservice Teacher Education," April 1970:

> "A District Master Plan for Inservice Teacher Education shall encompass a period of 5 years. On the basis of the information obtained from the self-evaluation and other pertinent information, the Master Plan shall be developed and updated annually. Amendments to the plan can be submitted at any time. When submitting an amendment to the office of the Administrator, Educational Personnel Development, three copies of the proposed component(s) and the TE-2 forms should accompany the letter of request.
>
> "For each component, there shall be a statement of objectives, a summary statement describing the procedures to accomplish the objectives, and the procedure for evaluating the degree to which the objectives have been achieved."

- -

AUTHORIZED FOR SUBMISSION TO THE STATE OF FLORIDA, DEPARTMENT OF EDUCATION:

______________________ ASSOCIATE SUPERINTENDENT FOR INSTRUCTION D

1. SUGGESTED TITLE FOR COMPONENT:
SCHOOL BASED MANAGEMENT OF PROGRAM DEVELOPMENT

2. BRIEF DESCRIPTION OF THE COMPONENT:

This component provides opportunities for teachers and administrators to affect program improvements by developing and applying generic school level decision making skills. A procedures manual describing the school based management system includes guidelines for participant activities from the initial identification of needs to the summative evaluation of the implemented product. In anticipation of needs that might arise in the process of program development, various other of the Master Plan's component designs are specified as referents. Emphasis is placed upon the satisfaction of program needs.

3. GENERAL OBJECTIVES: (Competency areas required of educational personnel which this program addresses.)

(1) Generate and implement program improvements that satisfy the related school level needs and provide for district and state responsiveness.

(2) Increase program effectiveness and local acceptance of change by developing and applying the generic school level decision making skills associated with program development, introduction, and continuation.

4. SPECIFIC OBJECTIVES: (Measurable, enabling objectives which lead to the attainment of the general objectives.)

(1) Identify program needs.
(2) Generate and/or select and organize objectives and evaluative criteria by sequence and level as needed.
(3) Identify, adapt, and/or develop the activities, materials, strategies, and other resources needed to appropriately support the teaching/learning situation.
(4) Provide for trial periods and revisions.
(5) Provide for introduction into the system.
(6) Provide for continuation.
(7) Establish formative and summative evaluation procedures.
(8) Demonstrate the acquisition of the needed decision making skills.

5. EVALUATIVE PROCEDURES:

A. Procedures or measures to determine the degree to which objectives have been achieved by the participants.

(1) Local school site instructional leader verifies extent of participation in the component activities by signature on procedures manual "Program Development Checklist."
(2) The development of the needed program components is verified by providing the appropriate extent of organized objectives and evaluative criteria, selected activities, and organized resources.

(3) Experimental editions indicate the trial periods and revisions provided.
(4) Plans for introduction into the system and continuation are provided.
(5) Participants match the program components to the identified needs to verify the validity of the summative evaluation.
(6) Participants generate sample components utilizing their acquired decision making skills.

B. External evaluation of the effectiveness of the component. External evaluation is implemented by a local school site administrator, the area staff director, and the district consultant in the designated subject area.
"Participant Reaction" forms provide for workshop evaluation.

6. PROPOSED ACTIVITIES: (Description of planned program designed to accomplish the objectives.)

Teacher participants, under the direction of the local school site instructional leader, identify program needs. As indicated by the needs, participants develop such program components as organized objectives and evaluative criteria, learning activities, and strategies for applying other resources. Participants provide for trial periods and revisions, alternatives for introduction into the system, and plans for continuation. Participants utilize various components of the Florida Individualized Teacher Education Modules as needed.

CLASS SESSIONS	TASK
1, 2, 3	Organize objectives and evaluative criteria
4, 5, 6	Generate designated number of learning activities
7, 8	Plan for the application of other resources
9, 10, 11, 12	Provide trial periods and revisions
13	Provide for introduction into the system
14	Plan for continuation (maintenance, reevaluation, support, installation)
15	Evaluation (internal and external)

7. TYPE OF PROGRAM: (Check the one descriptive term that best describes the format for activities.)

X_Workshop __Course __Meeting or Conference __Self-Instructive

8. LOCATION FOR OFFERING:________________________

9. SCHEDULE FOR OFFERING: 15 class sessions (minimum of one semester required)

10. CREDIT

MASTER PLAN POINTS: _____60_ (Based upon 15 hours of instructional time per 20 Master Plan Points.)

PIP UNITS:__3__(Based upon 1 PIP unit per 20 MPP.)

MASTER PLAN CATEGORY (Check one which best identifies the component.)

_____BASIC SKILLS and knowledge required for effective teaching, supervision, or administration (such as classroom management, preparation of behavioral objectives, audio-visual operation).

__X__UPDATING SKILLS and knowledge in specific subject or service areas (such as individualization of reading instruction, peer counseling techniques, quinmester curriculum).

__X__EXPLORATORY ACTIVITIES -- open-ended miscellaneous components which are not easily defined, taught, evaluated, predicted or controlled (such as conferences with specific measurable objectives).

IF COLLEGE OR UNIVERSITY CREDIT IS ALSO REQUESTED FOR THIS PROGRAM, SHOW THE INSTITUTION REQUESTED AS SPONSOR:

____

11. ESTIMATED COSTS FOR CONDUCTING OFFERING: (Complete items which are applicable.)

COST FOR INSTRUCTOR(S)	_______	(@$13.73 per hour)
COST FOR SUBSTITUTES	_______	(@$30.00 per day)
COST FOR PARTICIPANTS' TIME	_______	(at hourly rate of participants)
COST OF MATERIALS, ETC.	_______	
COST OF TRAVEL & PER DIEM FOR CONSULTANTS	_______	

12. NAME OF REQUESTED INSTRUCTOR: LOCAL INSTRUCTIONAL LEADER

NAME OF INSTRUCTOR'S WORK LOCATION:______________________

ADDRESS:_______________SCHOOL MAIL CODE:____PHONE:______

QUALIFICATION OF INSTRUCTOR TO CONDUCT THIS OFFERING:

____

APPENDIX C

SCIENCE EDUCATION: ELEMENTARY SCHOOL

OBJECTIVES, SELECTED ACTIVITIES, AND ASSESSMENT ITEMS

SCIENCE EDUCATION:

ELEMENTARY SCHOOL OBJECTIVES,
SELECTED ACTIVITIES, AND
ASSESSMENT ITEMS

1 9 7 7

PREFACE

The materials in this bulletin were compiled and/or generated and organized in order to provide a consistent, sequential curricular structure in science education for students throughout their elementary school years. Similarly, the curricular structure was designed to minimize fragmented and duplicative educational efforts resulting from the intervention of such influences on learning as personnel changes and textbook revisions.

The bulletin was an outgrowth of the implementation of the staff development component entitled "School Based Management of Program Development." The generic component design provided for the development of school level decision making skills in the process of generating and implementing the curricular structure.

Participants utilized as a basic referent the validated criterion-test items and objectives of the State of Florida Department of Education's Florida Catalog of Science Objectives, Series 13, Volume I, "Biological Sciences," Volume II, "Physical Sciences," Volume III, "Earth-Space Sciences," Level: Elementary School, Chipley, Florida: Panhandle Area Educational Cooperative, 1974. Efforts for program development were also supported by materials from the State of Florida Department of Education's individualized teacher education modules.

Opportunities for a comparative evaluation of the designation of objectives by grade level were provided by the results of efforts by personnel from the South Central Area Curriculum Center to organize the materials of the Florida Catalog of Science Objectives.

Activities for program development were expedited by the helpful suggestions of Mrs. Harriet Ehrhard, Science Education Consultant, Dade County Public Schools, and Mrs. Dorothy C. Isbell, Staff Director Dade County Public Schools. In addition, the various personnel efforts were fully supported by Mr. Michael Liebman, Principal, Dade County Public Schools. The assistance provided by these educators was highly beneficial and appreciated.

This bulletin is one of the appendices in a report prepared in partial fulfillment of the degree requirements of the National Ed. D. Program for Educational Leaders, Nova University.

Marilyn Polin,
Artist

Jean Moeller
Miami, Florida
1977

CONTENT CLASSIFICATION

The content classification specifies for each objective the appropriate category of informational emphasis.

The information or knowledge of science is classified into three categories: Biological Sciences, Physical Sciences, and Earth/Space Sciences. In order to further specify the content, descriptive subdivisions are provided for each of the three main categories.

I. Biological Sciences

- A. Variety & Pattern (Plants)
  (physical characteristics and life processes)
- B. Variety & Pattern (Animals)
  (physical characteristics and life processes)
- C. Variety & Pattern (Microbes)
  (physical characteristics and life processes)
- D. Survival & Adaptation
  (genetic and environmental)
- E. Interaction & Interdependence
  (populations and communities
- F. Continuity & Change
  (health and environment)

II. Physical Sciences

- A. Matter
  (states, structure, and properties)
- B. Energy and Force
  (gravitational, heat, light, mechanical, sound, etc.)
- C. Matter-Energy Changes
  (physical, chemical, and space/time)
- D. Interaction with Man
  (materials and energies)

III. Earth-Space Sciences

- A. Earth
  (geological development, external and internal processes, history, and interaction with man)
- B. Water
  (features of oceans and lakes, movement, and interaction with man)
- C. Air
  (characteristics of atmosphere, weather elements and systems, and interaction with man)
- D. Space
  (features of moon, planets, stars; motions of astronomical objects; and exploration by man)

PROCESS CLASSIFICATION

The process classification specifies for each objective the appropriate skill area emphasis.

COMMUNICATING

Students express and exchange ideas by utilizing oral and written words, diagrams, maps, graphs, mathematical equations, and/or various kinds of visual demonstrations.

OBSERVING

Students identify characteristics that are perceived through the senses.

CLASSIFYING

Students group, segregate, identify, name, or form categories that have systematic relationships founded on common properties or characteristics.

USING SPACE/TIME RELATIONSHIPS

Students develop skills in describing spacial relationships and their change with time, location, and distance. The process includes a study of shapes, symmetry, motion, and rate of change.

MEASURING

Students ascertain the quantity, mass, extent, or degree of particular information in terms of a standard unit or fixed amount such as a ruler or a cylinder.

INTERPRETING DATA

Students explain, analyze, and give meaning to qualitative and quantitative information that has been systematically gathered.

DEFINING OPERATIONALLY

Students specify an operational definition that includes a testable inference of what must be done and the expected outcomes in order to identify or construct an object, a situation, or an event.

IDENTIFYING VARIABLES

Students identify factors that are capable of change within a system.

PREDICTING

Students utilize given data to tell in advance what future results may be.

FORMULATING HYPOTHESES

Students develop inferences (based on observations) that are generalized to include all objects or events of the same class.

EXPERIMENTING

Students carry out an operation under predetermined conditions in order to discover some unknown principle or effect or to test, establish, or illustrate some suggested or known truth.

INFERRING

Students make statements about objects or events which are based on observations but which are not the result of direct perception.

NO PROCESS

Objectives not classified into one of the above categories are designated as no process. Generally, a recall of information is required.

KINDERGARTEN OBJECTIVES

BIOLOGICAL SCIENCES

K:1-11

1. Variety & Pattern (Plants)-Classifying

   The student will be able to match pictures of mature plants to their seeds. (pine cone, peanut, acorn, etc.)

2. Variety & Pattern (Plants)-Classifying

   The student will be able to classify items as capable of growth or not capable of growth. (BB's, seeds, paper clips, cheese, etc.)

3. Variety & Pattern (Plants)-No Process

   The student will be able to recall that nuts, berries, and pods contain seeds.

4. Variety & Pattern (Animals)-No Process

   The student will be able to recall that an insect has six legs and three body parts.

5. Variety & Pattern (Animals)-Observing

   The student will be able to identify feathers as one of the differences between pictures of birds and other animals.

6. Variety & Pattern (Animals)-Observing

   The student will be able to identify pictures of both adult and juvenile mammals of the same species.

7. Variety & Pattern (Animals)-Observing

   The student will be able to classify an object as being bitter, sweet, sour, or salty. (salt water, lemon water, sugar water, quinine water, etc.)

8. Variety & Pattern (Animals)-No Process

   The student will be able to choose the type of clothing he/she would prefer to wear under different conditions.

9. Variety & Pattern (Animals)-Classifying

   Given pictures of animals ranging from one cell to many cells, the student will be able to identify them as all being animals.

10. Survival & Adaptation-Classifying

    The student will be able to apply the concept of "Like begets like" by distinguishing among pictures of parents and possible offspring.

11. Interaction & Interdependence-Inferring

    The student will be able to identify a situation which depicts competition by applying the concept of competition in the animal kingdom. (two dogs pulling a bone, two people racing against each other, a coyote chasing a rabbit, a fish catching a frog, etc.)

KINDERGARTEN OBJECTIVES
BIOLOGICAL SCIENCES

K:12-14

12. Interaction & Interdependence-Classifying

    The student will be able to classify animals as to the correct community. (pasture, forest, mountains, etc.)

13. Continuity & Change-Classifying

    The student will be able to choose that meal which is the best in terms of nutritional aspects.

14. Continuity & Change-Observing

    The student will be able to identify pictures not having pollution from among similar pictures of pollution.

KINDERGARTEN OBJECTIVES

K:15-21

PHYSICAL SCIENCES

15. Matter-Classifying

Given containers of one liquid, one solid, and one gas and asked to identify the three states, the student will be able to select the appropriate container.

16. Matter-Predicting

The student will be able to name the object in each of several sealed boxes with holes punched in the top each containing an object possessing a distinctive odor by using his/her sense of smell. (banana, pine needles, soap, peppermint stick, etc.)

17. Matter-Formulating Hypotheses

Given a demonstration illustrating conservation of matter, the student will be able to state that the same amount of matter is present regardless of its shape.

18. Energy & Force-No Process

The student will be able to identify batteries or electricity as needed and use the batteries to make a toy or light source operative.

19. Matter-Energy Changes-Using Space/Time Relationships

The student will be able to inflate and release a balloon.

20. Matter-Energy Changes-Using Space/Time Relationships

The student will be able to apply the concept that events occur in a sequence by ordering the events in a set of drawings.

21. Matter-Energy Changes-Using Space/Time Relationships

Given a pair of scissors and several pairs of lines, the student will be able to cut a line between each pair of lines.

KINDERGARTEN OBJECTIVES

EARTH-SPACE SCIENCES

22. Water-Using Space/Time Relationships

Given drawings of seashells and shapes, the student will be able to match the shapes with each type of shell.

23. Water-Using Space/Time Relationships

The student will be able to state that waves move in all directions at a comparatively slow rate.

24. Water-No Process

When asked how he/she uses water, the student will be able to recall that he/she uses water for drinking, washing, or playing by so stating.

25. Water-Classifying

The student will be able to identify in a diagram of things people do for pleasure, those which must have water to be enjoyed.

26. Air-No Process

The student will be able to choose from pictures of a raindrop and a snowflake the one he/she would prefer and state why. (The nature of the choice is irrelevant, but the reason for the choice should be consistent with the choice.)

27. Air-No Process

The student will be able to recall that the definition of wind is air in motion.

28. Air-No Process

The student will be able to choose from pictures of a rainy day and a clear day, the one he/she would prefer and state why. (The nature of the choice is irrelevant, but the reason for the choice should be consistent with the choice.)

K:1

LEVEL: KINDERGARTEN

CONTENT: Biological Sciences

Variety & Pattern (Plants)

PROCESS: Classifying

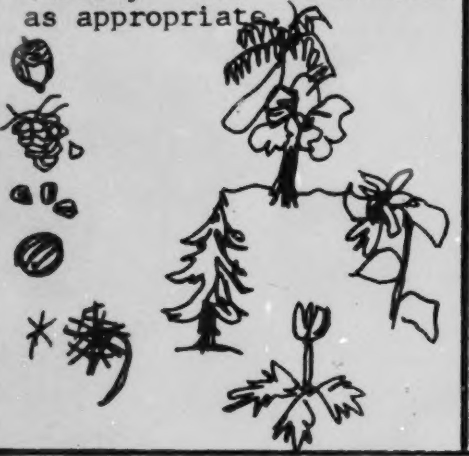
MATCHING PLANTS AND THEIR SEEDS

OBJECTIVE #1

The student will be able to match pictures of mature plants to their seeds. (pine cones, peanut, acorn, etc.)

ASSESSMENT #1

Match the seed to its mature plant in the following drawings. (Modify oral directions as appropriate.)



RELATED ACTIVITY

Make a seed collection. Include the seeds of oranges, grapefruit, lemons, cucumbers, watermelons, tomatoes, and beans. Label the collection with pictures of the mature plant.

Questions:
How do plants form new plants?
How do trees form new trees?
What plants will form from these seeds? (Test this hypothesis by growing some plants from seeds.)

Ask students to bring in labels from canned goods, boxes, cellophane packages, and seed packets. Soak a glassful of large seeds, such as lima beans, overnight. Each student should have one to examine. Help the students to see the tiny leaves of the plant and the part that will become a root. Discuss the value of the seed coat for protecting the seed and the see halves for furnishing food for the baby plant.

MATERIALS

- seeds from oranges, grapefruit, lemons, cucumbers, watermelons, tomatoes, and beans
- pictures of the above plants
- one lima bean seed for each student
- large glass
- water
- magnifying glass or magnifying stand

LEVEL: KINDERGARTEN

CONTENT: Biological Sciences
Variety & Pattern (Plants)

PROCESS: No Process

K:3

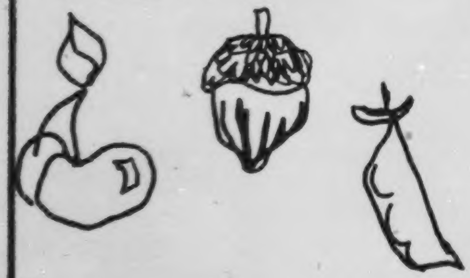
TAKING A SEED WALK

OBJECTIVE #3

The student will be able to recall that nuts, berries, and pods contain seeds.

ASSESSMENT #3

What is found inside of each of these? (Provide for oral questioning and responding.) (Pictures should include a cherry berry, an acorn or pecan nut, and a pea pod or bean pod.)



RELATED ACTIVITY

(Suggested by activities in "Early Childhood Science" by North Central Area Resource Personnel, Dade County Public Schools)

Invite students to look for seeds on a walk around the school ground or nearby park. Take a walk in the fall and one in the spring and point out the differences in the "finds." Discuss with the students why there is a difference. Through this discussion, help the students to realize that there are many different kinds of containers for seeds and that there are more seeds at certain times of the year. Make a collection of the different kinds of seed containers.

MATERIALS

adequate supervision
magnifiers

LEVEL: KINDERGARTEN

CONTENT: Biological Sciences

Variety & Pattern (Animals)

PROCESS: Observing

K:5

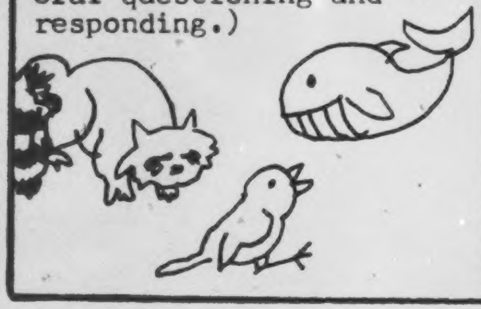
TAKING AN ANIMAL WALK

OBJECTIVE #5

The student will be able to identify feathers as one of the differences between pictures of birds and other animals.

ASSESSMENT #5

Here are pictures (or drawings) of three animals. Look at the bird. What does this bird have besides a beak and/or wings that the other animals do not have? (Provide for oral questioning and responding.)



RELATED ACTIVITY

(Suggested by activities in "Early Childhood Science" by North Central Area Resource Personnel, Dade County Public Schools)

Take the students on a walk to look for animals. Tell them to look in the cracks of sidewalks, in gutters, in grassy places, against the sides of buildings, in puddles, under rocks, in piles of leaves, beneath the bard of a rotting log, in trees, and in the air. If there is a park nearby, the students can look on the banks of streams or ponds. (Adequate supervision and appropriate safety precautions are indicated.) Magnifiers are suggested for the observation of small animals. Students may find various animals or indications of animals such as eggs, shed skins, tracks, etc.

Upon return to the classroom, discuss the similarities and differences of the observations. Pictures or murals are suggested.

MATERIALS

- supervision for each group of six students
- magnifiers
- drawing paper or chart paper
- crayons or paint

LEVEL: KINDERGARTEN
CONTENT: Physical Sciences
Matter
PROCESS: Classifying

K:15

FINDING DIFFERENT KINDS OF MATERIALS

OBJECTIVE #15

Given containers of one liquid, one solid, and one gas and asked to identify the three states, the student will be able to select the appropriate container.

ASSESSMENT #15

Is a solid, a liquid, or gas in container #1? (Repeat for containers #2 and #3.) (Provide for oral questioning and responding.)

Alternate Assessment: In which container is the solid object? (Repeat for liquid and gas.) (Provide for oral questioning and responding.)

RELATED ACTIVITY

Divide the class into couples or small groups. Assign an area to each couple or group and ask for a report on the different kinds of materials in that location. As they report, indicate the materials named. Emphasize the different states of liquid, solid, and gas.

Have the students use their senses to discover the properties of materials they bring to school: look for shape, size, and color; feel for weight; observe whether they are hard or soft, rough or smooth; smell them; caution not to use sense of taste; and listen to sounds as they bend or break the materials (with permission). Emphasize and explore the use of the senses to group the materials as solids, liquids, or gasses.

MATERIALS

- glass or plastic containers for collecting liquid and gaseous materials
- table for grouping materials

LEVEL: KINDERGARTEN
CONTENT: Physical Sciences
Matter
PROCESS: Predicting

K:16

EXAMINING ODOR BOXES

OBJECTIVE #16

The student will be able to name the object in each of several sealed boxes with holes punched in the top each containing an object possessing a distinctive odor by using his/her sense of smell. (banana, pine needles, soap, peppermint stick, etc.)

ASSESSMENT #16

Here are four boxes with holes punched in the tops. Without opening the boxes, use your sense of smell and tell me what is in each box.

RELATED ACTIVITY

(Suggested by activities in "Early Childhood Science" by North Central Area Resource Personnel, Dade County Public Schools)

Advance Preparation:
Collect four objects such as garlic, onion, a fresh flower, vinegar, sauerkraut, cologne; put one in each box. If it is liquid, pour a sample on a cotton ball. If the object is likely to rattle, tape it securely inside the box before closing the lid.

Teaching Suggestions:
Show the students the boxes. Invite a student to select one and to describe the odor he/she smells. Repeat the activity on other occasions using other objects. Students can sort the boxes based on whether they like or dislike the smell. Ask them to explain their choice. Vary the activity by putting the same kind of objects in two boxes or comparing pictures.

MATERIALS

for each group of six to eight students:
- 4 shoe boxes
- 4 objects with strong odors
- tape
- cotton balls (optional)

magazines for locating, cutting, and pasting related pictures or pictures of like and dislike smells
paste
newsprint
scissors

K:17

LEVEL: KINDERGARTEN
CONTENT: Physical Sciences
Matter
PROCESS: Formulating Hypotheses

CHANGING SHAPES OF OBJECTS

OBJECTIVE #17

Given a demonstration illustrating conservation of matter, the student will be able to state that the same amount of matter is present regardless of its shape.

ASSESSMENT #17

(Present a ball of clay to the student and ask him/her to observe it. Then roll the clay into a long cylinder and ask the following question.) Does the long piece of clay have less, more, or the same amount of clay as the ball?

RELATED ACTIVITY

Place some colored water in a low, wide, clear container. Mark the height of the water with tape. Pour the colored water into a tall, narrow, clear container. Mark the height of the water in the second container with tape. Then point to the tall, narrow, clear container and ask whether the container has more than, less than, or the same amount of water as the other container had earlier. Test the response by returning the liquid to the original container.

Obtain an equal-arm balance. Place clay rectangles of equal size on each end of the balance. Indicate the balanced state of the two piece by observing the condition of the equal arm balance. Change the shape of one of the clay piece to that of a ball. Ask if, when it is returned to the balance, the piece will have more, less, or the same amount of clay as before. Test the hypothesis by returning the ball of clay to the balance.

MATERIALS

1 low, wide, clear container
1 tall, narrow, clear container
colored water
tape

equal-arm balance
(Suggest prior experience with this instrument using such sets of small objects as crayons, buttons, checkers, blocks.)

LEVEL: KINDERGARTEN

CONTENT: Earth-Space Sciences

Water

PROCESS: Using Space/Time Relationships

K:22

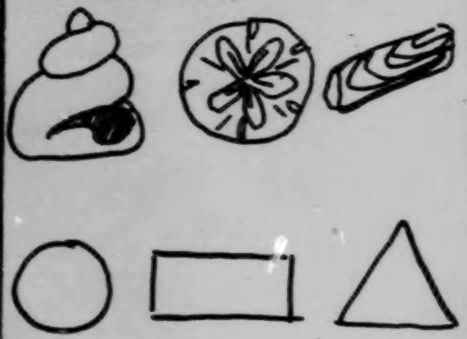
OBSERVING SEASHELLS

OBJECTIVE #22

Given drawings of seashells and shapes, the student will be able to match the shapes with each type of shell

ASSESSMENT #22

Draw a line connecting the shape that matches the seashell.



RELATED ACTIVITY

The selection of objects will depend on what is available in the area. Distribute the collections of shells and ask the students to sort them by similar shapes. The students should be able to explain their sorting.

MATERIALS

- for each group of six to eight students:
  - 8-10 seashells (provided by the teacher)
- for the teacher
  - plastic bags for sorting when students explain

LEVEL: KINDERGARTEN

CONTENT: Earth-Space Sciences

Air

PROCESS: No Process

K:27

LEARNING ABOUT THE WIND

OBJECTIVE #27

When asked to define wind, the student will be able to recall that the definition of wind is air in motion.

ASSESSMENT #27

1. State a definition for wind.
   (or)
2. What is wind? (Provide for oral questioning and responding.)

RELATED ACTIVITY

Children will learn to make a small paper windmill. Wind (moving air) causes pinwheels to turn. When the same principle is used on a large scale, the wind can be made to do beneficial work.

Procedure

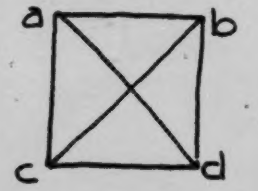
1. Cut a piece of construction paper to a 6" square.
2. Draw diagonal lines from A to D and from B to C. (See sketch.)
3. Cut to within ½" of point from four corners along these diagonal lines.
4. Fold points X to center and put the pin through S and the center where lines cross.
5. Attach to the end of the wooden stick by forcing the point of the pin into the stick.
6. Blow into the center of the pinwheel or hold pinwheel in any current of air.

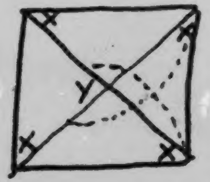
Questions

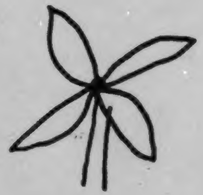
How does this paper windmill work? What makes it go?

MATERIALS

wooden stick about 6" long
straight pin
construction paper
sketch







KINDERGARTEN RELATED MATERIALS K:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
1. Matching mature plants to their seeds.	MATCHING PLANTS AND THEIR SEEDS	P:55 1:22-23 2:6-27	PREOP I: #19 PREOP II: #30	1:219-223		
2. Classifying items as capable of growth or not.		P:51-52 1:40-45 2:154	PREOP I: #13 PREOP II: #13, 32	K:27-29 K:42-46 1:219-222		
3. Recalling that nuts, berries, and pods contain seeds.	TAKING A SEED WALK	2:6-7	PREOP II: #30	1:361-366		
4. Recalling that an insect has 6 legs and 3 body parts.			PREOP I: #5, 17	K:65-68		
5. Identifying feathers as unique to birds.	TAKING AN ANIMAL WALK	2:136	PREOP I: #3, 9, 16 PREOP II: #29			
6. Identifying adult and juvenile mammals of same species.		1:7 2:144	PREOP II: #2			
7. Classifying bitter, sweet, sour, and salty objects.				1:213-215 1:297-304		

KINDERGARTEN RELATED MATERIALS K:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
8. Choosing clothing for different conditions.			PREOP I: #27			
9. Identifying animals as those with one and many cells.			PREOP II: #26, 33	1:233-234		
10. Distinguishing from among pictures of parents and offspring.		1:7				
11. Identifying competition in the animal kingdom.			PREOP II: #27			
12. Classifying animals according to community.		1:12-13 1:20-21	PREOP II: #26			
13. Choosing the most nutritional meal.			PREOP I: #6, 27			
14. Identifying pictures without pollution.		1:138-143 2:168-171	PREOP I: #7			

KINDERGARTEN RELATED MATERIALS K:15-21

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
15. Identifying the solid, liquid, and gaseous states of matter.	FINDING DIFFERENT KINDS OF MATERIALS	P:47-48 1:94-127 2:102-111	PREOP I: #22-24 PREOP II: #12, 28	K:56-61 K:90-91 K:151-154		
16. Identifying distinctive odors by using sense of smell.	EXAMINING ODOR BOXES	2:118-119	PREOP I: #14	1:116-218		
17. Describing conservation of matter.	CHANGING SHAPES OF OBJECTS	2:124		1:256-261		
18. Identifying the energy needed to operate objects.		P:25-36 1:84-93 2:80-101	PREOP II: #24	K:145-147		
19. Inflating and releasing balloons.		P:13				
20. Sequencing events in a set of drawings.		P:55 1:68-71 1:82	PREOP II: #7, 8, 9			
21. Cutting between pairs of lines.						

KINDERGARTEN RELATED MATERIALS

K:22-28

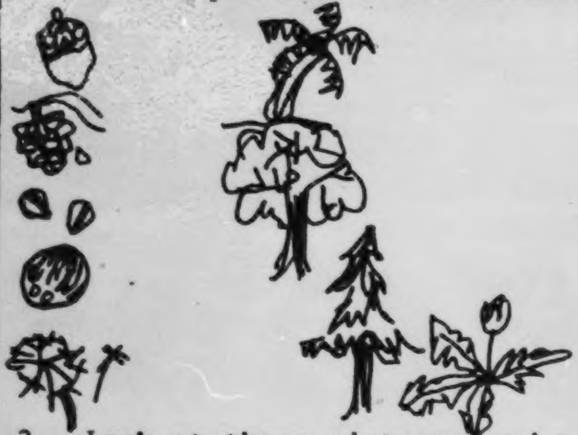
OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
22. Matching drawings of shapes and seashells.	OBSERVING SEASHELLS		PREOP II: #18	K:30-33 K:51-55 K:85-94		
23. Indicating that waves move slowly in all directions.						
24. Recalling that water is used for drinking, washing, playing.		P:47, 48				
25. Identifying pleasurable activities that require water.		P:29-30 P:47				
26. Substantiating a preference for a raindrop or a snowflake.						
27. Recalling that wind is air in motion.	LEARNING ABOUT THE WIND	1:125	PREOP II: #25	K:141-144		
28. Substantiating a preference for a rainy day or a clear day.						

KINDERGARTEN ASSESSMENT ITEMS

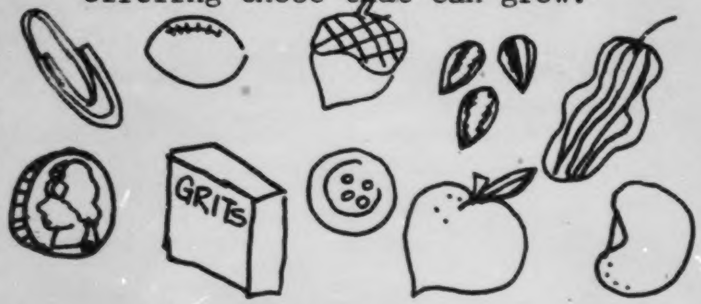
BIOLOGICAL SCIENCES

K:1-5

1. Draw a line from the picture of the seed to the picture of its mature plant.

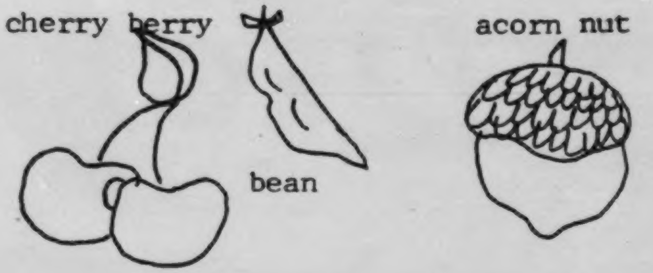


2. Look at these pictures and tell me if the things represented can grow by circling those that can grow.



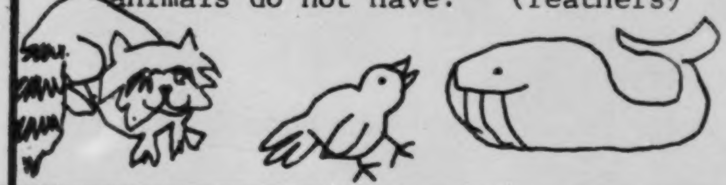
(Answers: 3, 4, 5, 9, 10)

3. What is found inside each of these? (seeds)



4. Many people mistake all kinds of bugs as insects. To tell the difference between a bug and an insect, a person should count the legs and body parts of the animal. If it is an insect, how many legs and body parts would it have? (6 legs and 3 body parts)

5. Here are three animals. Look at the bird. What does this bird have besides a beak or wings that the other animals do not have? (feathers)

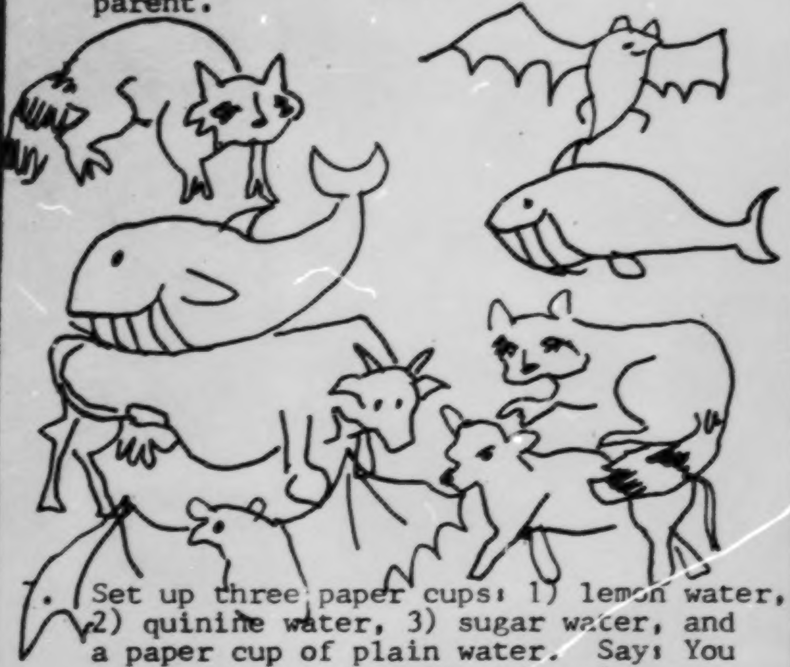


KINDERGARTEN ASSESSMENT ITEMS

K:6-9

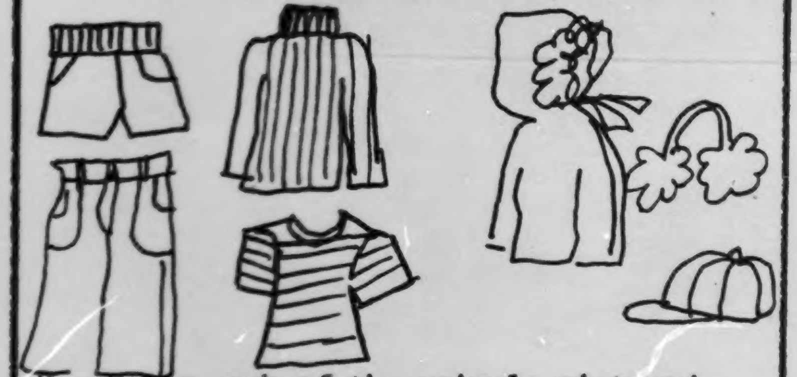
BIOLOGICAL SCIENCES

6. Draw a line from the picture of the baby animal to the picture of its parent.

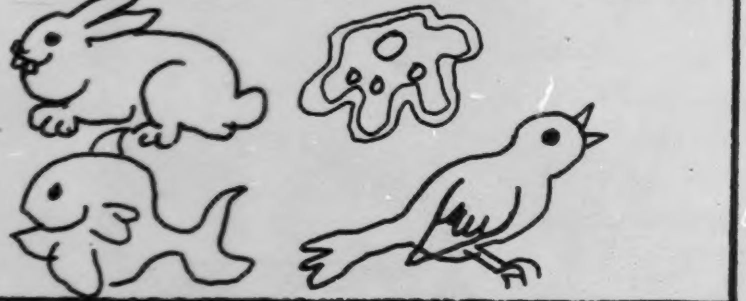


7. Set up three paper cups: 1) lemon water, 2) quinine water, 3) sugar water, and a paper cup of plain water. Say: You are never to taste liquids unless you are told to do so. In this case, you are going to taste the liquids one at a time and tell me whether it is bitter, sweet, sour, or salty. After you taste each one, rinse your mouth out with the plain water before tasting the next one.

8. If you were in a place that had snow on the ground, which clothes would you want to put on to play outdoors and why would you pick those clothes? Circle the clothes you would wear. (Read instructions to students.)

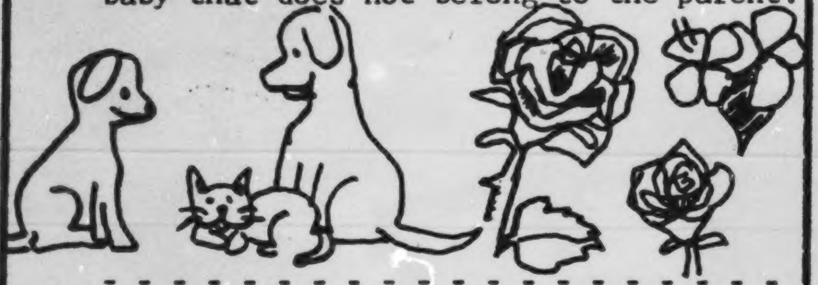


9. Color each of the animals pictured below. (Tell what the one celled animal is.) (All should be colored.)



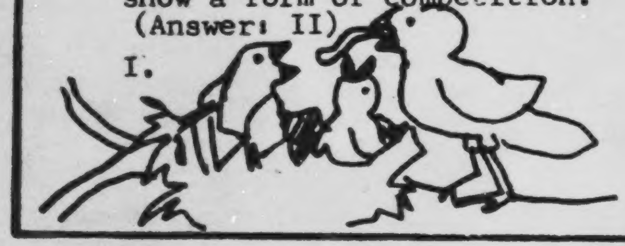
KINDERGARTEN ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

10. Here are some pictures of a parent and two babies. Draw a circle around the baby that does not belong to the parent.



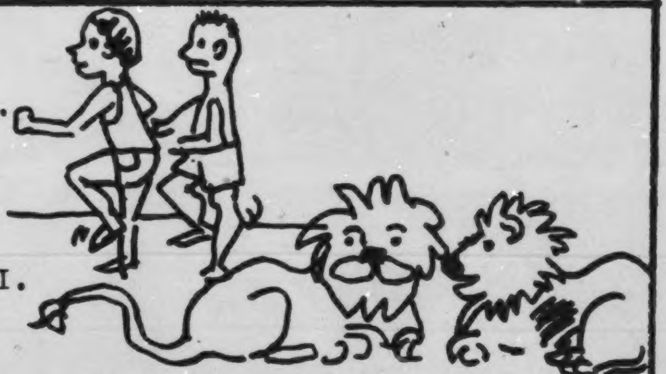
11. Here are three pictures of things happening. Some of the pictures show competition. Circle the pictures which show a form of competition.
(Answer: II)

I.

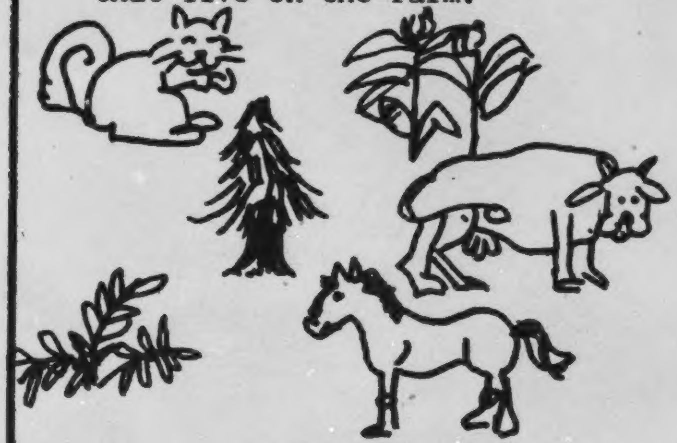


II.

III.



12. Look at the animal and plant pictures. Circle the ones that live in the forest. Put an X on the ones that live on the farm.

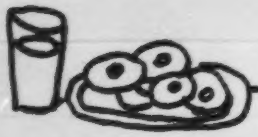


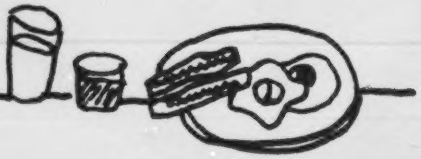
KINDERGARTEN ASSESSMENT ITEMS

K:13-14

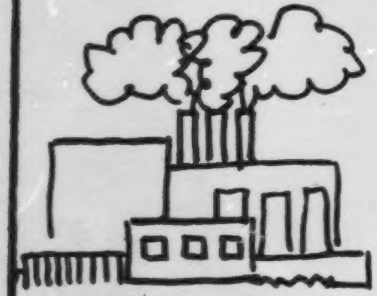
BIOLOGICAL SCIENCES

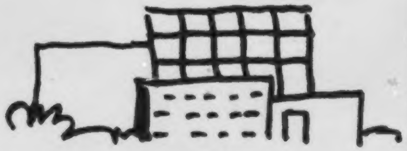
13. Below are two pictures of meals you might have for lunch. Put a circle around the meal which is better for you.



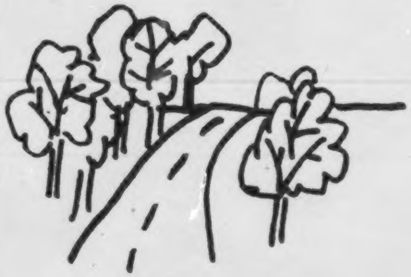


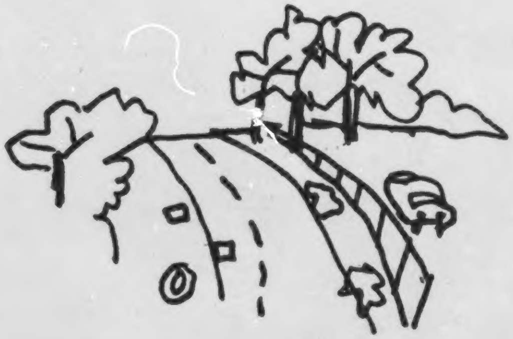
14. Draw a circle around the picture in this set that does not show pollution.





14. (continued)
Draw a circle around the picture in this set that does not show pollution.





KINDERGARTEN ASSESSMENT ITEMS K:15-21

PHYSICAL SCIENCES

15. Provide sealed, numbered, transparent containers, one of a liquid, one of a solid, and one of a gas (air). Say: Is a solid, a liquid, or a gas in container #1? (Repeat for containers #2 and #3.)

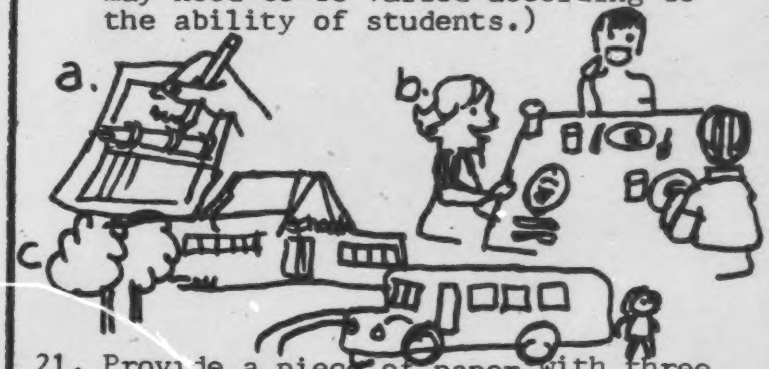
16. Provide four small boxes, each containing a familiar object with a distinctive odor (e.g., banana, pine needles, soap, peppermint stick), each box being sealed with several pin holes punched in the top. Say: Here are four boxes with holes punched in the top. Without opening the boxes, use your sense of smell and tell me what is in each box.

17. Present the student with a ball of clay and ask the student to observe it. Roll the clay into a long cylinder. Say: Does this long piece of clay have more, less, or the same amount of clay as the ball?

18. Provide a battery operated toy or flashlight neither requiring more than 2 cells and the appropriate kind and number of cells. Say: What is needed to make the toy work? Make it work for me.

19. Here is a balloon. Blow it up and let it go. (Caution student not to inflate balloon to its bursting point.)

20. On this page are three drawings of events that could happen each day to you. Look at each drawing and see if there is an order to these events. Write the number 1 by the event that happens first each day (allow time for marking). Write the number 2 by the event that happens second each day. Write the number 3 by the event that happens last each day. (Marks may need to be varied according to the ability of students.)

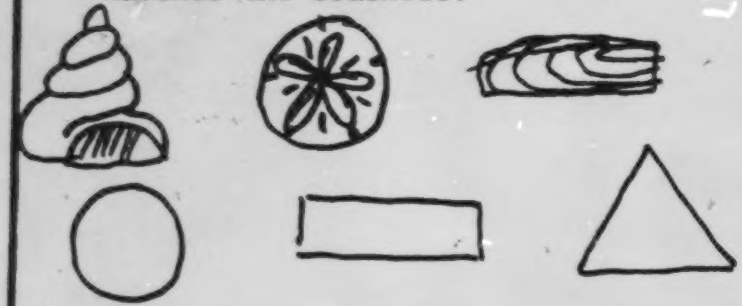


21. Provide a piece of paper with three pairs of lines. Pairs of lines are separated by a distance of 0.5 centimeters and have a length of 20 centimeters. Say: Cut a line between each of the three pairs of lines.

KINDERGARTEN ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

K:22-28

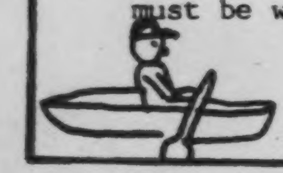
22. Draw a line connecting the shape that matches the seashell.

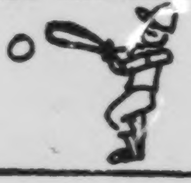


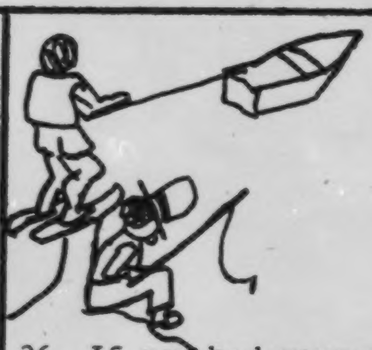
23. Drop a pebble in a large pan of water. Say: What happened to the surface of the water when the pebble was dropped in the water? Did they move fast or slow? (Student states that waves travel in all directions at a slow rate when pebbles are dropped in the water.)

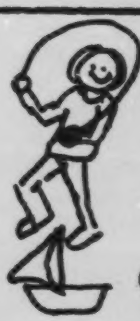
24. Perhaps you use water for different things than your neighbor. How do you use water? (drinking, cleaning, playing)

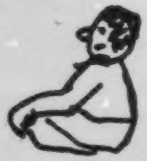
25. Here are six pictures of outdoor activities. Circle the ones where there must be water.



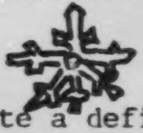


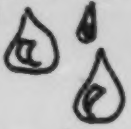






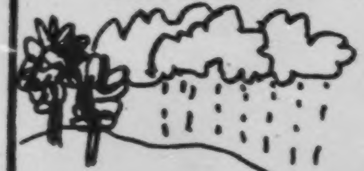
26. If you had your choice of the raindrop or the snowflake in the picture, which would you choose and why would you make that choice? (Reason must be consistent with choice.)

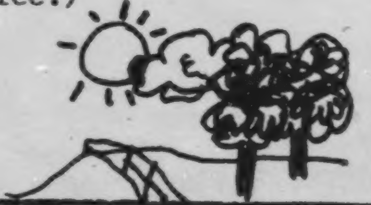




27. State a definition for wind. (Wind is the motion or movement of air.)

28. If you had your choice of the two days shown in the pictures, which day would you choose? Why? (Reason must be consistent with choice.)





GRADE ONE OBJECTIVES
BIOLOGICAL SCIENCES

1:1-10

1. Variety & Pattern (Plants)-Classifying

   The student will be able to identify the parts of a plant. (roots, stem, leaves, flowers, etc.)

2. Variety & Pattern (Plants)-No Process

   The student will be able to recall the names of at least four plants that have underground stems. (potatoes, bananas, onions, tulips, etc.)

3. Variety & Pattern (Plants)-Predicting

   Given pictures of two plants, the student will be able to apply the concept that plants grown in the dark will not grow as healthily.

4. Variety & Pattern (Plants)-No Process

   When asked to select whether the flower or the fruit forms first on a plant, the student will recall and state to the effect that the flower gives rise to the fruit.

5. Variety & Pattern (Animals)-Observing

   The student will be able to identify the three major body parts of an insect in the adult stage by labeling a drawing of the insect.

6. Variety & Pattern (Animals)-Observing

   The student will be able to identify adult fish of the same age but different species as being many sizes.

7. Survival & Adaptation-Communicating

   Given a list of environments, the student will be able to select one and tell what it would be like to be an animal or plant living in that environment.

8. Variety & Pattern (Animals)-No Process

   The student will be able to recall that most insects have both wings and legs for moving from place to place.

9. Survival & Adaptation-Inferring

   Given life cycles of animals, the student will be able to depict the stages of another animal.

10. Interaction & Interdependence-Classifying

    Given a picture showing many populations, the student will be able to identify a population as all of the same species living within a given area.

GRADE ONE OBJECTIVES
BIOLOGICAL SCIENCES

1:11-13

11. Continuity & Change-Classifying

    The student will be able to identify three reasons for bathing.

12. Continuity & Change-Classifying

    Given a list of items, some related to good health, the student will be able to identify those which are related to good health.

13. Continuity & Change-No Process

    The student will be able to recall that man has learned to use plants for his own benefit.

GRADE ONE OBJECTIVES
PHYSICAL SCIENCES

14. Matter-Observing

The student will be able to identify the changes that occurred in a piece of ice in a container at room temperature by describing the form that it took after the change.

15. Matter-Observing

Given a balance with an inflated and deflated balloon on each end, the student will be able to discriminate between the two balloons by pointing to the inflated balloon as the heavier one.

16. Matter-Experimenting

Given solid substances, a water supply, and stirrers, the student will be able to determine which of the substances dissolve in water. (sugar, instant tea, paraffin, moth flakes, sand, baking soda, etc.)

17. Matter-Classifying

Given a mixture of solids (e.g., aquarium sand, table salt, baking soda, ping pong balls, moth balls, pearl tapioca, and salt) and separating devices (e.g., a set of sieves), the student will be able to separate the mixture into its component parts by making different piles for each substance.

18. Energy & Force-Observing

The student will be able to discriminate between such pairs of sounds as loud and soft, short and long, high and low.

19. Energy and Force-Classifying

The student will be able to group objects within a set after testing them with a magnet as attracted or not attracted by the magnet.

20. Energy & Force-Defining Operationally

Given a demonstration of exerting a force on an object (e.g., a box full of books), the student will be able to apply the concept that force is an action of pulling, pushing, and lifting.

21. Matter-Energy Changes-Using Space/Time Relationships

The student will be able to discriminate between measuring time with a clock and with a calendar by matching drawings of events with their correct measuring device.

22. Matter-Energy Changes-Using Space/Time Relationships

The student will be able to identify up, down, right, left, forward, and backward by moving in these directions.

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LEVEL: GRADE ONE

CONTENT: Biological Sciences
Variety & Pattern (Plants)

PROCESS: Classifying

1.1

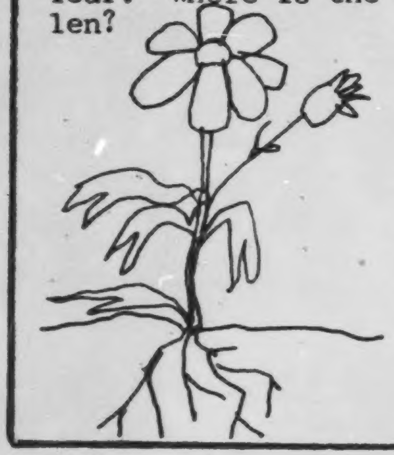
IDENTIFYING THE PARTS OF A PLANT

OBJECTIVE #1

The student will be able to identify the parts of a plant. (roots, stem, leaves, flowers, etc.)

ASSESSMENT #1

On this picture of a flowering plant, point to the root, the stem, the flower, and the leaf. Where is the pollen?



RELATED ACTIVITY

Collect a variety of flowering plants. Identify the parts of each. Discuss the differences.

Germinate pollen grains:
Make a strong sugar solution and place it in a shallow dish like a saucer. Shake pollen from several kinds of flowers onto the surface of the sugar solution. Cover it with a sheet of glass and let stand in a warm place for several hours. By using a magnifying glass or hand lens, students will be able to see little tubes growing from the pollen grains. Discuss the similarities and differences.

MATERIALS

- a variety of flowering plants
- sugar solution
- 1 saucer for each type of pollen used
- hand lens or magnifying glass or stand

LEVEL: GRADE ONE
CONTENT: Biological Sciences
Variety & Pattern (Plants)
PROCESS: Predicting

1:3

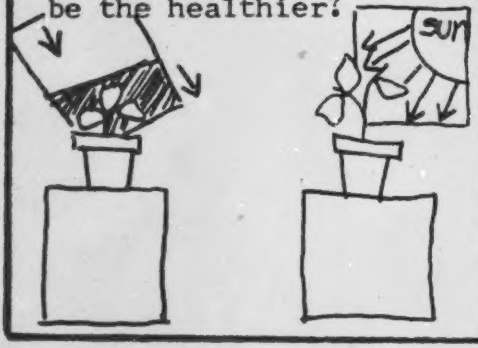
DEMONSTRATING PLANT NEEDS

OBJECTIVE #3

Given pictures of two plants, the student will be able to apply the concept that plants grown in the dark will not grow as healthily.

ASSESSMENT #3

Here are two plants. If you were to place one under a box for one week and the other in the sun for the same amount of time, which plant would be the healthier?



RELATED ACTIVITY

Utilize potted plants to determine what plants need to grow. Guide students to set up an experiment in which four plants are each deprived of one of the following: water, soil, sun, and food. In addition, deprive one plant of air by placing a glass jar over the plant. (This plant will demonstrate a deposit of water droplets over the inside of the jar, will become limp and die due to lack of air--mainly CO_2. Are there other possible reasons?) Supply a control plant with each of the above. Observe the effects of each deprivation.

Consider comparing plants grown in different types of soil. Consider hydroponic farming of potatoes, onions, etc.

Observe the plants over a period of time. Indicate the differences.

MATERIALS

- 5 pairs of matched plants
- 1 jar to enclose a plant
- water
- fertilizer

1:13

LEVEL: GRADE ONE
CONTENT: Biological Sciences
Continuity & Change
PROCESS: No Process

LEARNING HOW MAN USES PLANTS

OBJECTIVE #13

The student will be able to recall that man has learned to use plants for his own benefit.

ASSESSMENT #13

List as many ways as you can that tell how man has learned to use plants for his own benefit. (alternate assessment-draw pictures of the ways)

RELATED ACTIVITY

Examine the ways that man has learned to use plants for his own benefit. Utilize one or more of the following activities:

1. experience chart,
2. displays,
3. pasteboard with magazine pictures, and
4. cut and paste magazine booklets by students.

Include the following ways that man has learned to use plants for his own benefit: food, medicine, shelter, fuel, clothing, rebuilding the soil.

MATERIALS

Materials vary according to designated activity.

LEVEL: GRADE ONE

1:16

CONTENT: Physical Sciences

Matter

PROCESS: Experimenting

DISSOLVING SOLID SUBSTANCES

OBJECTIVE #16

Given solid substances, a water supply, and stirrers, the student will be able to determine which of the substances dissolve in water. (sugar, instant tea, paraffin, moth flakes, sand, baking soda, etc.)

ASSESSMENT #16

(Read each exercise orally. Caution student not to add an amount of substance that could not dissolve in the quantity of water used.)

Try to dissolve each solid material in a separate container of water. Find out which of the solid materials dissolves in water. (sugar, instant tea, moth flakes, baking soda)

RELATED ACTIVITY

Procedure:

1. Put sand, salt, sugar, flour in separate containers.
2. Fill each container with water and stir.
3. Observe each container.
4. The amount of sand, sugar, salt, and flour to be used depends upon the size of the container used. If too much salt and sugar are used they will settle to the bottom. Use about a tablespoon of each substance for each pint of water.

Questions:

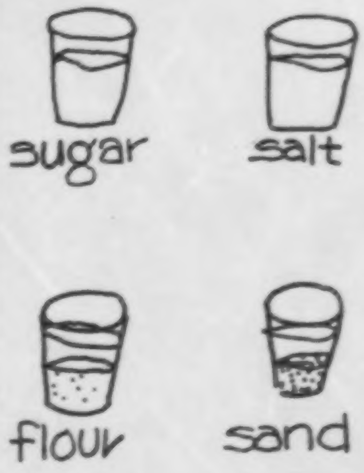
1. What do we mean when we say "water soluble?"
2. How can you determine how much sugar or salt will dissolve in a cup of water?

Results:

1. Flour and sand do not dissolve in water.
2. Salt and sugar dissolve in water.

MATERIALS

for each group of six to eight students:
4 containers
salt, tablespoon
sugar, tablespoon
flour, tablespoon
sand, tablespoon
water



LEVEL: GRADE ONE

CONTENT: Physical Sciences
Energy & Force

PROCESS: Classifying

1:19

TESTING SUBSTANCES WITH MAGNETS

OBJECTIVE #19

The student will be able to group objects within a set after testing them with a magnet as attracted or not attracted by the magnet.

ASSESSMENT #19

Using your magnet to divide the objects you have into a group attracted to the magnet and a group not attracted to the magnet.

RELATED ACTIVITY

Guide students to determine what kinds of substances are attracted to magnets.

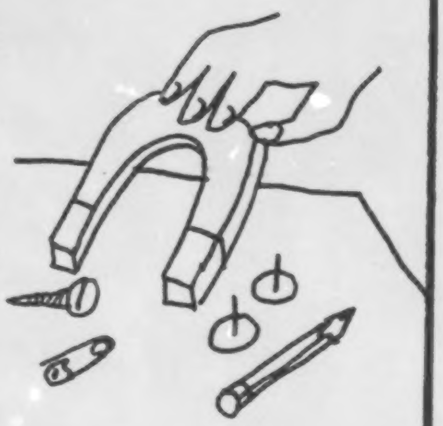
Procedure:
1. Place the objects on a table.
2. Touch the magnet against each object.
3. Observe the results.

Questions:
1. Why do magnets attract objects which contain iron or steel?
2. How can we test a metal to see if it contains iron?

Results:
1. Magnets attract iron and steel objects.
2. Magnets do not attract wood, copper, silver, or other objects which do not contain iron.

MATERIALS

for each group of six
to eight students:
magnet
nails
pins
pencils
copper
aliminum
dime
other small objects



LEVEL: GRADE ONE

CONTENT: Earth-Space Sciences

Water

PROCESS: Observing

1:25

IDENTIFYING SALT WATER

OBJECTIVE #25

Given containers of salt and fresh water, the student will be able to identify the salt water. (Students should be cautioned not to taste liquids without being told whether or not they are safe to taste.)

ASSESSMENT #25

Put an X in the box by the letters matching the samples of water which are salty.

A.________

B.________

C.________

D.________

Alternate Assessment:

Point to the containers which have salt water in them.

RELATED ACTIVITY

Students will determine why it is easier to swim in salt water.

Teacher Information:

The denser the water, the greater the buoyancy. Buoyancy is determined by the density of the liquid involved. Battery hydrometers use this principle. The denser the liquid, the stronger the battery.

Procedure:

1. Dissolve the salt in one of the glasses of water.
2. Place one egg in clear water, the other egg in salt water.
3. Stick thumb tacks in rubber tips of pencils.
4. Place one pencil in clear water, the other pencil in salt water. (tack ends down)

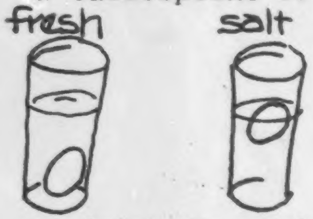
Questions:

Is salt water heavier than fresh water? Is salt water heavier than an egg?

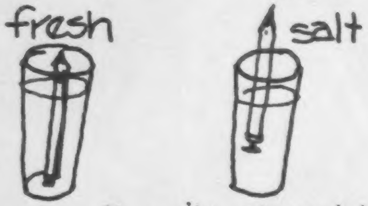
MATERIALS

for each group of six to eight students:

- 4 glasses two-thirds full of water
- 2 pencils
- 2 thumb tacks
- 2 chicken eggs
- 2 tablespoons of salt



chicken eggs



pencil with thumbtack

LEVEL: GRADE ONE

CONTENT: Earth-Space Sciences

Air

PROCESS: Interpreting Data

1:28

EXPERIMENTING WITH AIR PRESSURE

OBJECTIVE #28

Given a diagram of two series of events using a drinking straw and a glass of water, the student will be able to apply the concept that air exerts pressure.

ASSESSMENT #28

The two series of diagrams show different results. Why does the water stay in the straw after being lifted from the water when the top opening of the straw is closed? (Provide for oral questioning and responding.)

RELATED ACTIVITY

Guide the students to determine that air exerts pressure in all directions. Drawing air out of a paper bag would reduce the pressure inside of the bag. The greater pressure on the outside would push the sides of the bag in.

Procedure:

1. Hold a paper bag against your lips and blow it full of air.
2. Take the bag away from your lips. (The bag remains blown up because the pressure inside the bag is the same as outside.)
3. Press the open end of the bag against your lips and draw the air out. (The bag collapses.)

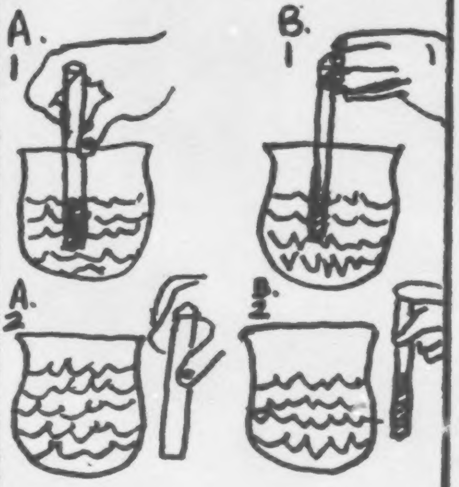
Questions:

Where does air exert pressure?
Why did the bag collapse?
Where does air exert pressure on people?
What is the effect of air pressure on airplanes and those who fly?

MATERIALS

paper bag

(ASSESSMENT DIAGRAM)



LEVEL: GRADE ONE

CONTENT: Earth-Space Sciences
Air

PROCESS: Using Space/Time Relationships

1:30

DESCRIBING THE CAUSE OF NIGHT & DAY

OBJECTIVE #30

Given a light source and a globe, the student will be able to apply the concept that one rotation of Earth is equivalent to one day.

ASSESSMENT #30

Using the globe and light source, demonstrate that one rotation of Earth is equivalent to one day.

RELATED ACTIVITY

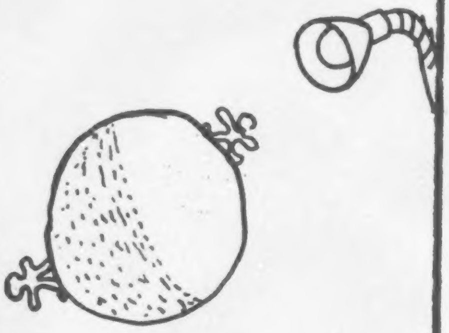
Use plasticine to attach a figure to the place where students are living on the globe. Attach another figure on the opposite side of the globe. Use a gooseneck lamp to represent the sun. Darken the room. Rotate the globe slowly. Note the way the figures move from day to night.

The fact that Earth rotates counterclockwise can be developed by having the students observe where they see the sun rise in the morning and set in the evening. Once the movement is established, compare it with the way the hands of a clock move.

Have students associate the position of the morning sun with landmarks around the neighborhood or near the school. Find an open spot on the school grounds. Drive a 5 foot stick into the ground. Have several students keep a record of the length of shadow from time to time (every hour).

MATERIALS

plasticine
globe
gooseneck lamp
five foot stick



GRADE ONE RELATED MATERIALS 1:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
1. Identifying parts of plants.	IDENTIFYING THE PARTS OF A PLANT	1:24-25 1:34-35	PREOP II: #5	K:65-71		
2. Recalling plants with underground stems.		1:22-35				
3. Predicting healthy plant conditions.	DEMONSTRATING PLANT NEEDS	1:24-33 1:39 2:154-155	PREOP I: #28 PREOP II: #22	K:24-26 K:137-140		
4. Recalling the flower forms before the fruit.		1:23	PREOP II: #7			
5. Identifying insect body parts.		1:6-9	PREOP II: #26, 32	K:65-71		
6. Identifying various sizes of adult fish.		1:12-13	PREOP I: #18			
7. Describing animal or plant environments.		1:12-15 1:20-21 1:25, 31-32 1:128-129	PREOP II: #14, 19			

GRADE ONE RELATED MATERIALS 1:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
8. Recalling most insects have wings and legs.		1:6-9	PREOP I: #17			
9. Depicting animal life cycles.		1:6-9 1:70-71 2:35-40 2:146-151	PREOP II: #8, 9			
10. Identifying a population.		1:21	PREOP II: #15			
11. Identifying reasons for bathing.						
12. Identifying good health items.			PREOP I: #26, 27			
13. Recalling ways man uses plants.	LEARNING HOW MAN USES PLANTS	1:34-37				
14. Identifying changes in ice.		1:106-107 1:114-118 2:69 2:106-108	PREOP I: #24 PREOP II: #12	K:56-61 K:151-154 1:194-203		

GRADE ONE RELATED MATERIALS 1:15-21

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
15. Identifying inflated balloon as the heavier balloon.		1"120-124				
16. Dissolving substances.	DISSOLVING SOLID SUBSTANCES	1:114 2:116	PREOP II: #21	1:311-315		
17. Separating a dry mixture with sieves.		1:134-137		3:28-39		
18. Discriminating between sounds.				2:32-40		
19. Grouping magnetic objects.	TESTING SUBSTANCES WITH MAGNETS	1:90-93	PREOP I: #30	K:148-150 1:316-321 1:326-331 2:56-61		
20. Describing force.		1:84-89	PREOP I: #11	K:145-147		
21. Measuring time with a clock or a calendar.		1:72-83 2:60-79				

1:22-28

GRADE ONE RELATED MATERIALS

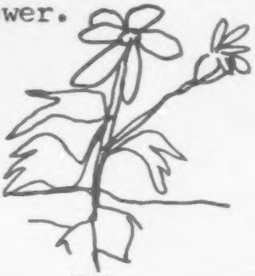
OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
22. Identifying up, down, right, left, forward backward.		1:32				
23. Recalling first order features of Earth.		1:112-114				
24. Recalling reptiles of long ago as dinosaurs.						
25. Identifying salt and fresh water.	IDENTIFYING SALT WATER	1:114		1:213-215		
26. Recalling water covers more than one-half of Earth's surface.						
27. Demonstrating how waves are formed.		1:125	PREOP II: #25			
28. Applying the concept that air exerts pressure.	EXPERIMENTING WITH AIR PRESSURE	1:124				

GRADE ONE RELATED MATERIALS 1:29-31

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77		
29. Identifying wind as the force that makes a kite go.		1:125-127 2:97	PREOP II: #25	K:141-144		
30. Demonstrating that one rotation of Earth is one day.	DESCRIBING THE CAUSE OF DAY AND NIGHT					
31. Identifying the number of hours in one rotation of Earth.		1:77-78				

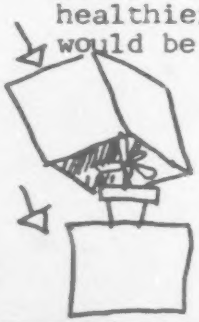
GRADE ONE ASSESSMENT ITEMS 1:1-7
BIOLOGICAL SCIENCES

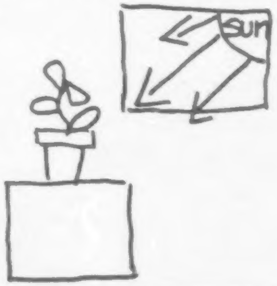
1. Take this drawing of a flowering plant and point to the root, the stem, the leaves, and the flower.



2. Some plants have stems like trees which grow above ground. Name five plants with underground stems. (potatoes, bananas, onions, tulips, bermuda grass, etc.)

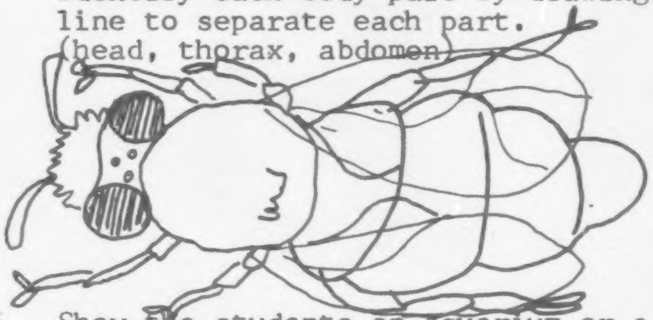
3. Here are two plants. If you were to place one under a box for one week and the other in the sun for the same amount of time, which plant would be the healthier? Circle the plant which would be healthier.





4. The flower and the fruit are two things found on a fruit tree. Which must come first?

5. Label the three major parts of the insect in the following drawing. Identify each body part by drawing a line to separate each part. (head, thorax, abdomen)



6. Show the students an aquarium or a picture of an aquarium with at least two kinds of fish of varying sizes and say: How are these fish of the same age different other than color and shape and kind? (size)

7. Here is a list of environments and plants and animals living there. Choose one from the list and tell what it would feel like to be an animal or plant living there.
(1) seashore-gull, sea oats
(2) swamp-alligator, water hyacinth
(3) deep ocean-shark, kelp
(4) pine grove-rattlesnake, palmetto

GRADE ONE ASSESSMENT ITEMS

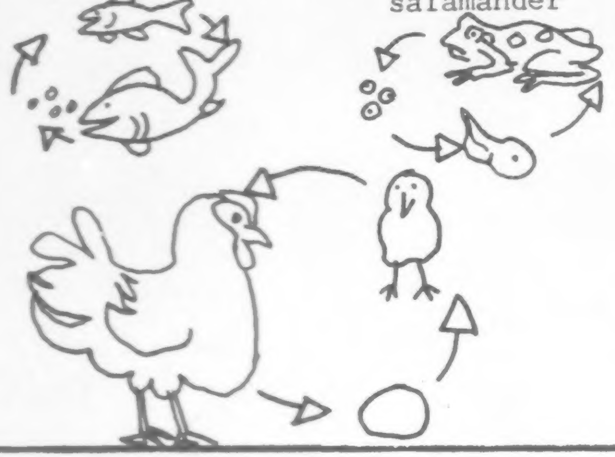
1:8-12

BIOLOGICAL SCIENCES

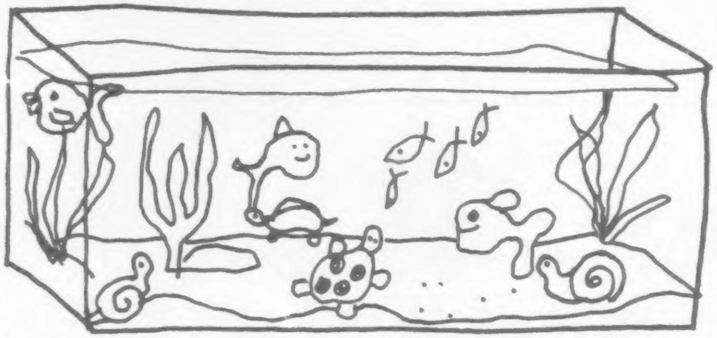
8. Provide students with pictures of insects with both wings and legs such as grasshoppers, crickets, flies, moths, praying mantis, butterflies, etc. Say: Most insects move from place to place in the same ways. Study the pictures and tell me what insects have that lets them move from place to place. (Most insects have both wings and legs to help them move from place to place.)

9. The three life cycles shown below are representative of those found in the animal world. Choose one animal from the list and draw its life cycle stages.

shark
alligator
grasshopper
duck
salamander



10. The picture you have shows different populations. Select one population in the picture and color it.



11. Place an X in front of the health reasons for taking baths and washing.

(1) ___To prevent germs from growing.
(2) ___To smell good.
(3) ___To look good.
(4) ___So that the skin can breathe.
(5) ___To prevent the spread of germs.
(Answers: 1, 4, 5; Accept 2, but not in lieu of 1, 4, or 5.)

12. Put an X in the blank if the activity is good for health. (Ans.: 1, 3.)

(1) ___Running or jogging around the block every day.
(2) ___Brushing your teeth only on Saturday morning.
(3) ___Sleeping 8 hours every night.

13. List as many ways as you can that tell how man has learned to use plants for his own benefit. (food, medicine, shelter, fuel, etc.)

PHYSICAL SCIENCES

14. Provide students with a piece of ice (approximately a 2 cm cube) in a clear container. Observe for several minutes. Say: How does the form of the material in the container now differ from the form you started with?
(Answers: The form now has spread out in the container. It was a lump. It is not hard as it was. When the container is moved, the material does not slip and slide like the lump. The lump had a whitish color but the material does not. It is liquid now.

15. Provide a balance stick and two identical balloons, one inflated and one deflated, attached to each end of the stick. A balance stick can be constructed by attaching a piece of string at the mid-point of a ruler and equal lengths of string to a balloon at each end. Say: Look at these two balloons. This one has air in it and this one does not. Point to the balloon that you think weighs the most. (Answer: The balloon with air is the heavier.)

16. Provide six solid substances, some of which are soluble in water (e.g., sugar, instant tea, paraffin, moth flakes, sand, baking soda) and containers of water and stirrers. Say: Here are some solids and containers, water, and stirrers. Find out which solids are soluble in water and name them. Students should be cautioned not to add an amount of substance that could not dissolve in the quantity of water used. (Answers: Sugar, instant tea, moth flakes, and baking soda are soluble.)

17. Provide a mixture of solids (e.g., aquarium sand, table salt, baking soda, ping pong balls, moth balls, pearl tapioca, and salt) and separating devices (a set of sieves). Say: Here is a mixture of solids. Here is a set of separating devices. Separate this mixture into different piles for each substance.

GRADE ONE ASSESSMENT ITEMS 1:18-21

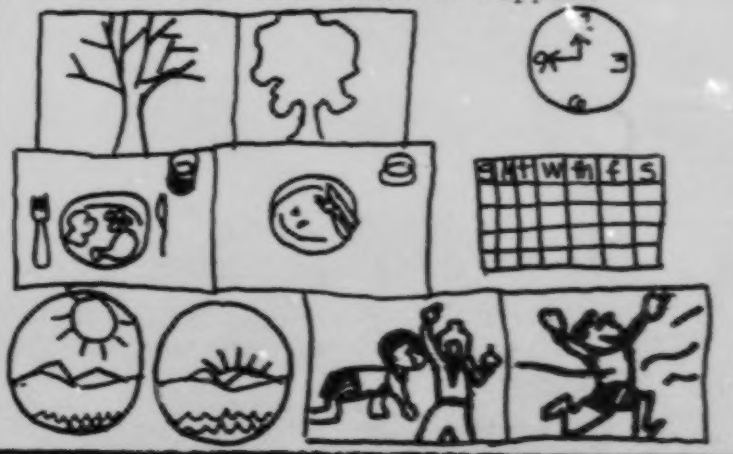
PHYSICAL SCIENCES

18. This instrument is called a tonette. If I blow into it, a sound is made. Turn away from me and listen to the sounds I will make. (Other reed instruments can be substituted for the tonette.) I will make two different sounds one right after the other. You tell me how the second sound is different from the first one. (Blow a note softly; after about four seconds, blow the same note loudly.) Good, I will make two other sounds and you tell me how they are different. (Blow a note for two seconds, pause for two seconds, blow the same note for four seconds.) How did the second sound differ from the first? Good, I will make two other sounds and again I want you to tell me how they are different. (Blow a note, pause for two seconds, blow a second note about three or four tones lower in pitch.) How did the second sound differ from the first? Good, the last two sounds I will make will also be different. Listen. (Blow a note, pause, make an oral statement such as "the sky is blue".) Which of the sounds I have just made carried a message, the first one or the second one?

19. Provide a magnet and 10 objects, some of which are attracted by the magnet. Say: Use your magnet to divide the objects you have into a group attracted to the magnet and a group not attracted to the magnet.

20. Watch me push, pull, and lift this object. (Utilize a box full of books.) Tell me what force is. (Force is an action of pushing, pulling, or lifting.)

21. Below are 4 events which can be measured either with a clock or a calendar. Draw a line from the event to the way you measure the time it takes for the event to happen.



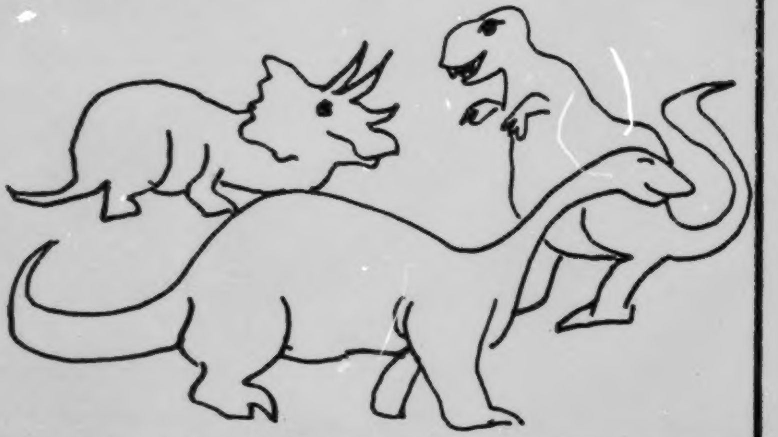
PHYSICAL SCIENCES - EARTH-SPACE SCIENCES

22. Please follow these directions:
    (1) Point your finger up.
    (2) Take two steps forward.
    (3) Raise your right hand.
    (4) Point your finger down.
    (5) Move your left foot backward.
    (6) Take three steps backward.

EARTH-SPACE SCIENCES

23. If you were up in space and could look down and see the earth without a cloud cover, what two big features of the earth would be most visible? (continents and ocean basins)

24. What is this group of animals called? Where can they be found today?



25. Provde containers labeled A, B, C, D, some containing salt water and others plain water. Say: Put an X in the box by the letters matching the samples of water which are salty. (Caution students not to taste liquids without being told whether they are safe to taste.) Students should use their senses to identify the salt water.
    A._______
    B._______
    C._______
    D._______

26. Provide a map of the world. Say: Look at this map of the world. The blue shows water. How much of the Earth is covered with water? (Answer: More than half of the Earth's surface is covered with water.)

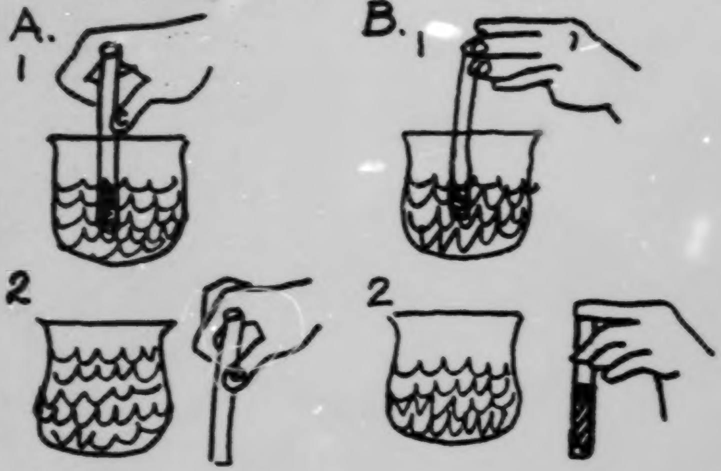
27. Provide a shallow tray of water. Say: Make waves on the tray of water. You may not touch the water, the tray, or the table with your hands or any object. Please do not jar the floor. (Answer: Students blow or fan the water.)

GRADE ONE ASSESSMENT ITEMS

1:28-31

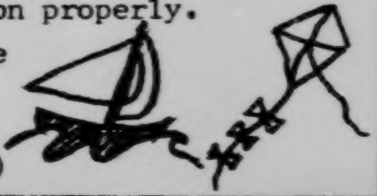
EARTH-SPACE SCIENCES

28. As shown in the two series of diagrams depicting a straw inserted and drawn from a beaker of water, why does the water remain in the straw when the top opening of the straw is closed?



29. Provided are drawings of a kite and a sailboat. Place an X next to the weather element listed below that each requires to function properly.

____(1) temperature
____(2) wind
____(3) humidity
____(4) rain
(Answer: #2, wind.)



30. Demonstrate with the globe and the light source provided that one rotation of the earth is equivalent to one day.

31. Place an X next to the number of hours listed below that it takes for the Earth to make one complete turn on its axis.

_____(1) 48 hours
_____(2) 12 hours
_____(3) 24 hours
_____(4) 36 hours

(Answer: #3, 24 hours.)

GRADE TWO OBJECTIVES

BIOLOGICAL SCIENCES

2:1-9

1. **Variety & Pattern (Plants)-Classifying**

   Given a flowering plant with the parts labeled and an operational definition of the parts, the student will be able to utilize the operational definition to identify the part of the plant that is defined.

2. **Variety & Pattern (Plants)-Predicting**

   Given a picture of an investigation on plant growth toward light, the student will be able to generate a prediction as to the growth pattern of the plant.

3. **Variety & Pattern (Plants)-No Process**

   Given a newly-sprouted bean seed in a glass of water, the student will be able to predict the direction of the stem and root growth.

4. **Variety & Pattern (Plants)-Classifying**

   Given a pine cone or its picture, the student will be able to identify each part by naming the parts as cone, scale, and seed.

5. **Variety & Pattern (Plants)-Communicating**

   Given a seed cone and a pollen cone, the student will be able to distinguish between them by identifying each cone's content.

6. **Variety & Pattern (Animals)-Classifying**

   The student will be able to identify from a list of animals those which are amphibians. (alligator, cotton-mouthed moccasin, bull frog, salamander, horned lizard, etc.)

7. **Variety & Pattern (Animals)-Classifying**

   The student will be able to identify animals belonging to the class reptilia.

8. **Variety & Pattern (Animals)-Classifying**

   The student will be able to classify man from other mammals by his physical characteristics.

9. **Variety & Pattern (Animals)-Communicating**

   The student will be able to identify pictures and recall the names of the stages in complete metamorphosis. (bee, ant, caterpillar, moth, mayfly, etc.) (egg, larva, pupa, and adult stages)

GRADE TWO OBJECTIVES

BIOLOGICAL SCIENCES

2:10-16

10. Variety & Pattern (Animals)-Classifying

    Given a picture of a fish, the student will be able to identify the fins which keep the fish balanced, the fins which act as oars, the fins which act as a steering mechanism, and the fins which act to propel the fish rapidly.

11. Variety & Pattern (Animals)-Inferring

    Given pictures of a grasshopper and a honeybee and asked to state in what manner and why their legs are modified, the student will be able to identify that the hind legs are modified on the grasshopper for jumping and on the honeybee for carrying pollen.

12. Variety & Pattern (Animals)-No Process

    The student will be able to recall that the hind legs of a frog are designed to help it swim because the toes are webbed.

13. Survival & Adaptation-Classifying

    The student will be able to identify a behavior as being inborn or learned.

14. Survival & Adaptation-Classifying

    The student will be able to apply and support the concept that living animals depend on other living things for food by selecting living things the animals might eat.

15. Continuity & Change-Inferring

    The student will be able to apply the concept of communicable diseases by constructing an inference on how a given disease could be spread.

16. Continuity & Change-Classifying

    Given a list of things man uses, the student will be able to classify them as needs or wants.

GRADE TWO OBJECTIVES

PHYSICAL SCIENCES

17. Matter-Classifying

Given a set of objects which include samples of solids, liquids, and gases, the student will be able to classify each sample as one of the three states of matter by properly placing the sample in one of three labeled categories.

18. Matter-Inferring

Given a demonstration of two inflated balloons placed on an equal-arm balance, seeing one of the balloons pricked, the student will be able to generate an inference by stating that the balloons are no longer in balance because the air (gas) that escaped has weight.

19. Matter-Predicting

Given several solid objects which will not float in water and which are added to a quantity of water with instructions to observe the water level before and after each object is added, the student will be able to originate a hypothesis to the effect that solids take up space by responding to the question as to the cause of the rise in water level.

20. Energy & Force-Predicting

Given an object, a smooth surface, and a rough surface, and directed to move the object with equal force over both surfaces, the student will be able to apply the concept that rough surfaces produce a greater frictional hindrance to oppose motion than smooth surfaces.

21. Energy & Force-Measuring

The student will be able to measure the shadows of three objects by manipulating a marked meter stick.

22. Energy & Force-Observing

Given information that some objects can be identified by their sound only, the student will be able to identify such objects using his sense of hearing by drawing the object according to the sound it makes. (penny, chalkboard eraser, book, pencil, etc.)

23. Energy & Force-Inferring

The student will be able to apply the concept that the amount of force required to move an object is directly proportional to the weight of the object by selecting from among 2 boxes-one empty and one containing objects-the one requiring the most force to move.

GRADE TWO OBJECTIVES

PHYSICAL SCIENCES

2:24-25

24. Matter-Energy Changes-Measuring

Given a thermometer and two liquids, the student will be able to measure and report the temperatures of both liquids.

25. Matter-Inferring

Given a description of mixing instant coffee in cold and hot water, the student will be able to generate a prediction that the coffee will mix faster in hot water.

GRADE TWO OBJECTIVES
EARTH-SPACE SCIENCES

26. **Earth-Classifying**

Given pictures of bodies of water, the student will be able to identify each as being a lake, a river, or an ocean.

27. **Earth-No Process**

The student will be able to identify from among a set of drawings of prehistoric animals those animal species which no longer exist.

28. **Earth-Interpreting Data**

Given a diagram of a stream, the student will be able to observe that the water flows downhill.

29. **Earth-Inferring**

Given a diagram of the water cycle, the student will be able to apply the concept that lakes are storage basins for large amounts of water which provide water for the surrounding land.

30. **Space-Observing**

Given diagrams of the moon, sun, and a planet, the student will be able to identify the one body of these three that is a satellite of Earth.

31. **Space-Classifying**

Given drawings of the relative sizes of the eight planets, the student will be able to classify the planets into groups on the basis of size.

32. **Space-No Process**

The student will be able to recall that a planet is a celestial object that orbits a sun.

33. **Space-No Process**

The student will be able to recall that a satellite is an object that orbits a planet.

34. **Space-Inferring**

Given a diagram of a crater with shadows from the sun, the student will be able to infer the direction from which the sunlight comes.

35. **Air-Inferring**

Given drawings or photographs during morning, at noon, and in the afternoon, the student will be able to describe two ways the shadows change.

20-5

LEVEL: GRADE TWO

CONTENT: Biological Sciences

Variety & Pattern (Plants)

PROCESS: Predicting

2:2

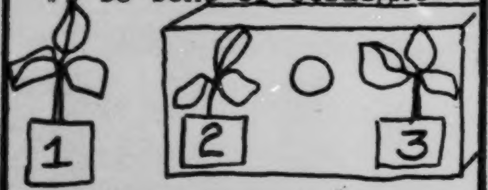
EXAMINING THE DIRECTION OF PLANT GROWTH

OBJECTIVE #2

Given a picture of an investigation on plant growth toward light, the student will be able to generate a prediction as to the growth pattern of the plant.

ASSESSMENT #2

These plants were watered and grown in a green house for one week; plants #2 and #3 in a black box. At the end of this week, will the: plant #1 be bent or straight; plant #2 be bent or straight; plant #3 be bent or straight?



RELATED ACTIVITY

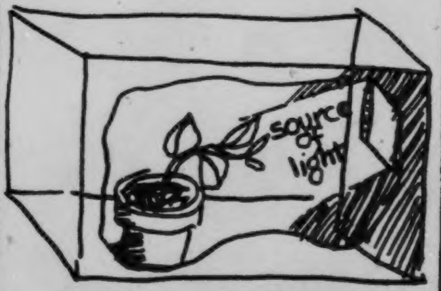
The students will be guided to determine that plants turn toward the light and continue to grow in that direction.

Procedure:
1. Plant radish seeds.
2. Give them water daily.
3. After seeds have begun to sprout, place pot in a light-proof box with a window cut in one end (see sketch). The only light entering the box should come through the window.

Questions:
1. What would happen to the plant if the pot were rotated half around (180 degrees) after the first few weeks?
2. What would happen if the hole were sealed?
3. What would happen if colored cellophane were placed over the hole?
4. In what direction do the roots of plants grow?

MATERIALS

radish seeds
flower pot
soil
water
cardboard box
tape for sealing box



LEVEL: GRADE TWO

CONTENT: Biological Sciences
Variety & Pattern (Plants)

PROCESS: No Process

2:3

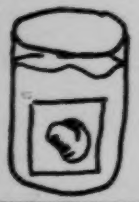
RECALLING THE DIRECTION OF ROOT GROWTH

OBJECTIVE #3

Given a newly-sprouted bean seed in a glass of water, the student will be able to predict the direction of the stem and root growth.

ASSESSMENT #3

This bean seed has been placed between two pieces of glass and left in water to sprout. Draw a dotted line to show the direction of growth that its stem will take and a straight line from the bean to show the direction that the root will take.



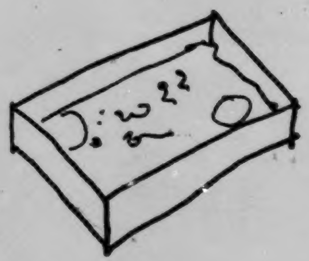
RELATED ACTIVITY

Guide the students to determine that, no matter in which direction a plant is tipped, the roots always grow directly toward the source of water.

Procedure:
1. Put moist soil in a flat, wooden box.
2. Plug the hole in one flowerpot with a cork and some melted paraffin.
3. Sink this flowerpot in one corner of the box of soil and fill the pot with water.
4. Diagonally across from the first flowerpot, sink an empty pot. (There is no need to plug the hole in this pot.)
5. Soak bean seeds in water overnight.
6. Plant the bean seeds here and there, putting a few near each flowerpot.
7. After about a week, take out the two pots.
8. Examine the direction of roots.

MATERIALS

1 flat, wooden box
moist garden soil
2 identical flowerpots
cork to fit the hole in one flowerpot
melted paraffin
water
bean seeds



LEVEL: GRADE TWO

CONTENT: Biological Sciences
Continuity & Change

PROCESS: Inferring

2:15

SPREADING COMMUNICABLE DISEASES

OBJECTIVE #15

The student will be able to apply the concept of communicable diseases by constructing an inference on how a given disease could be spread.

ASSESSMENT #15

Jim had two brothers, one sister, his mother, and his father living in the same house. One day Jim came home with a sore throat, headache, and fever. Jim's father called the family doctor, and the doctor diagnosed Jim's disease as the common cold. Within one week every member of Jim's family had the common cold. State three ways that the family could have contracted the cold from Jim.

RELATED ACTIVITY

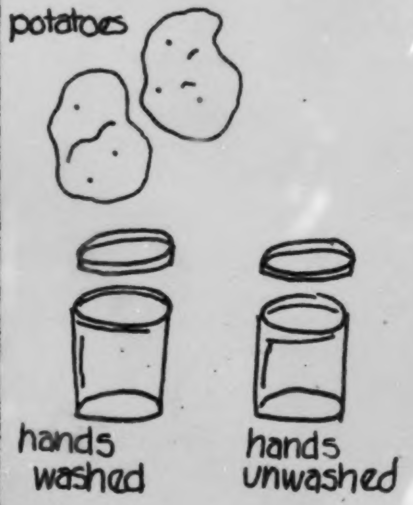
Guide the students to determine that germs grow in dirt and, therefore, get on the hands. Hands should be washed before handling food. This helps eliminate one way that germs cause illnesses.

Procedure:

1. Have two students volunteer to help with the experiment.
2. Send one of the students to the washroom to wash his/her hands as clean as possible.
3. Leave the second student with his/her hands unwashed.
4. Have both students peel a potato (or handle a peeled potato extensively) and place them each in sterile jars.
5. Label the jars with the students' names and either "Hands washed" or "Hands unwashed" as the case may be.
6. Place the jars on the science table and observe from day to day to no if any changes occur.
7. Record the observations.

MATERIALS

2 unpeeled potatoes
1 knife
2 glass jars that can be sterilized and sealed



LEVEL: GRADE TWO

CONTENT: Physical Sciences
Matter

PROCESS: Classifying

2:17

DESCRIBING THE THREE STATES OF MATTER

OBJECTIVE #17

Given a set of objects which include samples of solids, liquids, and gases, the student will be able to classify each sample as one of the three states of matter by properly placing the sample in one of three labeled categories.

ASSESSMENT #17

Label your three index cards with one of the states of matter. Each of the vials you have been given contains a material which you may observe by looking, smelling, and touching. Decide which state of matter each vial contains and place the vial on one of the cards you have labeled. (vinegar, oil, sugar, oleo, perfume, air)

RELATED ACTIVITY

Guide the students to examine the characteristics of each of the three states of matter.

Procedure:

1. Get a block of wood. Lay it on its side. Stand it on its end. Does it keep the same shape?
2. Pour some water from a large, full container into a smaller container. What shape does the water take in each container? Were you able to get all the water from the larger container into the smaller one?
3. Suppose there is a closed room with all the air taken out. In this room there is a closed bottle of air. If the bottle is opened, what will happen to the air in it?

Teacher Information:
Materials that keep the same shape are solids. Materials that take their shapes from their containers and occupy a definite amount of space is called a liquid. A gas has no shape of its own, and spreads through all the space open to it.

4. Collect and label various materials, utilizing as the basis the preceding experiences.
5. Demonstrate and discuss water in its three states.

MATERIALS

block of wood
large, glass container
small container
empty bottle
ice cubes
hot plate
kettle (with whistle)

LEVEL: GRADE TWO
CONTENT: Physical Sciences
Matter
PROCESS: Classifying

2:17

ILLUSTRATING THE THREE STATES OF MATTER

OBJECTIVE #17

Given a set of objects which include samples of solids, liquids, and gases, the student will be able to classify each sample as one of the three states of matter by properly placing the sample in one of three categories.

ASSESSMENT #17

Label your three index cards with one of the states of matter. Each of the vials you have been given contains a material which you may observe by looking, smelling, and touching. Decide which state of matter each vial contains and place the vial on one of the cards you have labeled. (vinegar, oil, sugar, oleo, perfume, air)

RELATED ACTIVITY

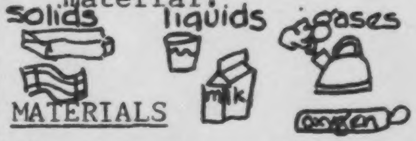
Guide the students to learn the different states of matter.

Procedure:
1. Make a chart showing the three states of matter as shown in the sketch.
2. Have the students classify the representative materials and add as many other items to each heading as they can.

Guide the students to learn that many forms of matter go from solids to liquids and finally into a gas. This procedure can work just the opposite. Set up a display labeling the various changes of state of matter.

There are some materials that do not go from one state into the next.

Procedure:
1. Place a mothball on a scale that you have constructed. Compare the mothball's weight with another object of similar weight.
2. Place the mothball in a cup for the rest of the the week.
3. Observe the size of the mothball from time to time.
4. Weigh the mothball and compare it to the weight of the other material.



MATERIALS

chart paper or chart tablet
magic marker
magazine or pictures of various states of matter
paste

mothball
similarly weighted object
scale
cup

LEVEL: GRADE TWO

CONTENT: Physical Sciences

Energy & Force

PROCESS: Predicting

2:20

DESCRIBING THE EFFECT OF FRICTION

OBJECTIVE #20

Given an object, a smooth surface, and a rough surface, and directed to move the object with equal force over both surfaces, the student will be able to apply the concept that rough surfaces produce a greater frictional hindrance to oppose motion than smooth surfaces.

ASSESSMENT #20

Here is an object (name the object to be used). I want you to move the object over this smooth surface and with the same force move the object over this rough surface. Now tell me why it is easier to move the object over the smooth surface than over the rough surface.

RELATED ACTIVITY

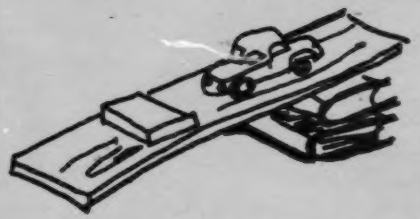
Students will discover that friction produces heat and causes wear. Lubrication reduces friction. Rolling friction is less than sliding friction. Ball bearings and roller bearings are examples of using rolling objects to reduce friction.

Procedure:

1. Hold hands in front of you, palms facing each other- rub hands together.
2. Rub a piece of sandpaper on a block of wood.
3. Take 2 blocks of wood (3" x 4") and slide them together.
4. Rub surfaces of blocks with soap or wax, and repeat above operation.
5. Place a flat board in a position so that one end is higher than the other.
6. Place a toy car on the higher end and release the car.
7. Rub the surface of the board with soap or wax and repeat above operation.

MATERIALS

for each group of six
to eight students:
- sandpaper
- 2 wood blocks
- toy car
- flat, rough board
- 3 books for elevating board
- soap or wax
- small wood block (to oppose car on inclined plane)



LEVEL: GRADE TWO

CONTENT: Physical Sciences

Energy & Force

PROCESS: Predicting

2:20

REDUCING THE EFFECT OF FRICTION

OBJECTIVE #20

Given an object, a smooth surface, and a rough surface, and directed to move the object with equal force over both surfaces, the student will be able to apply the concept that rough surfaces produce a greater frictional hindrance to oppose motion than smooth surfaces.

ASSESSMENT #20

Here is an object (name the object to be used). I want you to move the object over this smooth surface and with the same force move the object over this rough surface. Now tell me why it is easier to move the object over the smooth surface than over the rough surface.

RELATED ACTIVITY

Teacher Information:
More friction is evident when there are large, rough surfaces. Friction between rough surfaces can be reduced by the use of oil. Bearings change sliding friction to rolling surfaces.

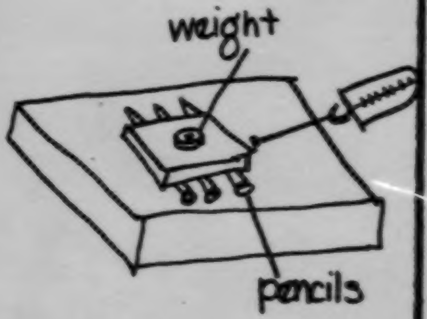
Procedure:

1. Place a small block with string attached to tack and scale on top of large block (see sketch).
2. Place weight on small block.
3. Pull scale and register reading when block begins to move.
4. Insert pencils between the two blocks and repeat #1, #2, and #3.
5. Spread a film of oil between the two blocks and repeat #1, #2, and #3.

Result:
The scale noted three different readings to move the blocks.

MATERIALS

for each group of six to eight students:
- 2 rough blocks of wood
- a small spring scale
- 2-3 round pencils
- 1 thumbtack
- a small weight
- small amount of "3 in 1" oil



LEVEL: GRADE TWO

CONTENT: Earth-Space Sciences

Space

PROCESS: Observing

2:30

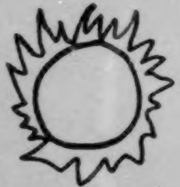
IDENTIFYING THE EARTH'S SATELLITE

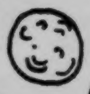
OBJECTIVE #30

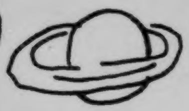
Given diagrams of the moon, sun, and a planet, the student will be able to identify the one body of these three that is a satellite of Earth.

ASSESSMENT #30

The illustration shows three bodies found in the solar system. Place a check mark below the one that is a satellite of Earth.







RELATED ACTIVITY

Teacher Information:

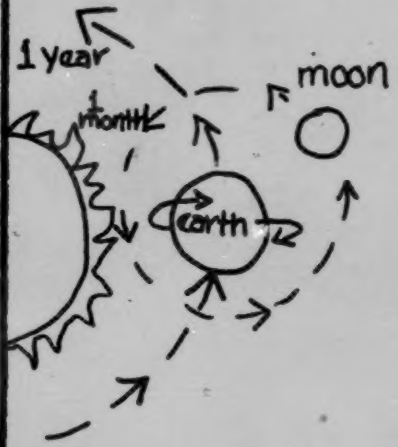
The moon travels from west to east around the earth and is, therefore, the earth's satellite. The moon rises about 55 minutes later each day. It travels completely around the earth from one full moon to another. This takes approximately 27 days.

Procedure:

1. Discuss with the class the concepts of rotation (spinning on its axis) and revolution (moving around another body).
2. Indicate that a satellite moves around another body (revolves).
3. Have three children come to the front of the room and explain the relative movements of the earth, moon, and sun. Let one student be the sun, one the moon and the other the earth. Have each student go through the motions of his/her celestial body.
4. Help students to become aware of the effect of the movements of sun and moon on the earth.

MATERIALS

globe
chalkboard
chalk
3 cards labeled "Earth", "Moon", and "Sun"



LEVEL: GRADE TWO

CONTENT: Earth-Space Sciences

Space

PROCESS: No Process

2:33

DESCRIBING A SATELLITE

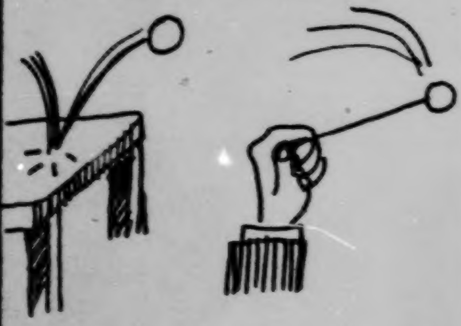
OBJECTIVE #33

The student will be able to recall that a satellite is an object that orbits a planet.

ASSESSMENT #33

Jupiter has 12 satellites. What is the meaning of the word satellite?

(Activity Sketch)



RELATED ACTIVITY

Teacher Information:

In the case of Earth satellites, the "moons" are sent so high and given an initial thrust to start them orbiting that, since a body in motion continues to stay in motion, the satellites continue to orbit. Because there is a very light density of air even at high altitudes, the "moons" will slow down, come closer to Earth, meet more dense air, and slow down still farther. This decay of the orbit continues until the satellites finally will fall to Earth or burn up as they meet increasingly dense air. This may take several hundred years as predicted for our small "explorer" series or may take a few days as in our heavier satellites that did not obtain very large orbits.

Procedure:

1. Drop the ping-pong ball on a table top. (Orbit is not achieved.)
2. Scotch tape two interlocked rubber bands to the ping-pong ball.
3. Slowly swing rubber bands, with ball attached, in a circular motion. Note the distance from your hand. (As the ball move slowly, it orbits (revolves) a certain distance from the hand.)
4. Increase the speed of circular swing. Note the distance in this case. (As the speed is increased, the ball moves farther from the hand.

MATERIALS

ping-pong ball
scotch tape
rubber bands

GRADE TWO RELATED MATERIALS 2:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77	AAAS	
1. Matching operational definitions to plant parts.		2:4-27 2:158-165	PREOP II: #5-6	2:22-31	Pt. 4: 33-37	
2. Predicting the growth pattern of a plant toward light.	EXAMINING THE DIRECTION OF PLANT GROWTH			K:24-26		
3. Predicting the direction of stem and root growth.	RECALLING THE DIRECTION OF ROOT GROWTH			K:24-26		
4. Identifying the cone, scale, and seed parts of a pine cone.		2:27				
5. Distinguishing between a seed cone and a pollen cone.						
6. Identifying animals which are amphibians.		2:140	PREOP II: #19			
7. Identifying animals belonging to the class reptilia.		2:140	PREOP II: #19			

GRADE TWO RELATED MATERIALS 2:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD. CURR.	COPES NYU '77	AAAS	
8. Distinguishing man from other mammals by physical characteristics.			PREOP I: #9			
9. Identifying and naming the stages in complete metamorphosis.		2:35-44				
10. Identifying the fish fins which balance, steer, row, propel.			PREOP I: #4		Pt. 3: 21-25	
11. Identifying reasons for bee and grasshopper leg modifications.					Pt. 3: 21-25	
12. Recalling how the hind legs of a frog help it to swim.		2:151			Pt. 3: 21-25	
13. Identifying behavior as inborn or learned.		2:28-34				
14. Supporting the concept that living animals depend on other living things.		3:174-211				

GRADE TWO RELATED MATERIALS 2:15-19

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD. CURR.	COPES NYU '77	AAAS	
15. Describing how a given disease could be spread.	SPREADING COMMUNICABLE DISEASES		PREOP I: #26-27		Pt. 3: 49-55	
16. Classifying things as needs or wants.						
17. Classifying according to the three states of matter.	DESCRIBING THE THREE STATES OF MATTER	2:102-111	PREOP I: #21-23 PREOP II: #12, 28		Pt. 3: 15-19	
	ILLUSTRATING THE 3 STATES OF MATTER					
18. Inferring that air has weight.		3:135-143		2:92-101		
19. Indicating that solids take up space by causing a rise in water level.		1:112-123		1:250-255		

GRADE TWO RELATED MATERIALS

2:20-25

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77	AAAS	
20. Stating that rough surfaces produce a greater frictional hindrance to oppose motion than smooth surfaces.	DESCRIBING THE EFFECT OF FRICTION	2:80 4:122-148	PREOP II: #11			
	REDUCING THE EFFECT OF FRICTION					
21. Measuring shadows.		2:72 3:78-79 3:90-91		2:80-91		
22. Identifying objects by using the sense of hearing.		2:130-131 4:210-216		2:32-47	Pt. 3: 167-173	
23. Selecting the box requiring the most force to move.		2:86-88			Pt. 3: 119-123 135-146	
24. Measuring the temperatures of liquids.		3:146-173	PREOP I: #25	1:269-275 3:215-226	Pt. 4: 131-139	
25. Predicting that mixing is faster in hot water than in cold water.		2:94-95	PREOP II: #21	2:147-159		

GRADE TWO RELATED MATERIALS

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77	AAAS	
26. Identifying lakes, rivers, and oceans.						
27. Identifying animals which no longer exist.					Pt. 3: 85-91	
28. Stating that water flows downhill.		2:129 4:16-33		1:322-325		
29. Describing that lakes are storage basins for large amounts of water.						
30. Identifying a satellite of Earth.	IDENTIFYING THE EARTH'S SATELLITE					
31. Classifying planets according to size.						
32. Recalling a planet is a celestial object orbiting a sun.						

GRADE TWO RELATED MATERIALS

2:33-35

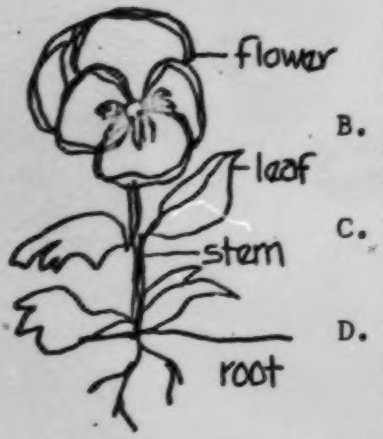
OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	EARLY CHILD.CURR.	COPES NYU '77	AAAS	
33. Recalling that a satellite is an object orbiting a planet.	DESCRIBING A SATELLITE					
34. Inferring the direction from which sunlight comes.		3:70-77				
35. Describing two ways shadows change.		3:64-80 3:88-92 3:118			Pt. 3: 131-133	

GRADE TWO ASSESSMENT ITEMS

2:1-3

BIOLOGICAL SCIENCES

1. Match the definition on the right to its term and location on the left.



A. The area of the plant where the majority of the food making takes place.

B. The portion of the plant having to do with reproduction.

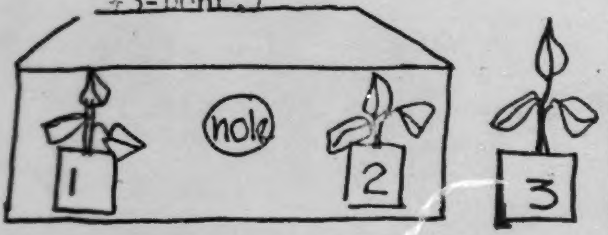
C. The area used to anchor the plant and store food.

D. The part of the plant which holds up the flower and leaves.

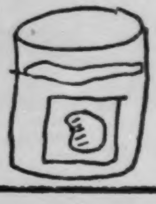
(Answers: A-leaf, B-flower, C-root, D-stem.)

2. These plants were watered and grown in a green house for one week, plants #2 and #3 in a black box. Plant #1 was grown in full light. Tell what way the plants will grow after one week this way.

Will plant #1 be bent or straight?____
Will plant #2 be bent or straight?____
Will plant #3 be bent or straight?____
(Answers: #1-straight, #2-bent #3-bent.)



3. This bean seed has been placed between two pieces of glass and left in water to sprout. Draw a dotted line to show the direction of growth that its stem will take and a straight line from the bean to show the direction of growth that the root will take.



GRADE TWO ASSESSMENT ITEMS 2:4-8

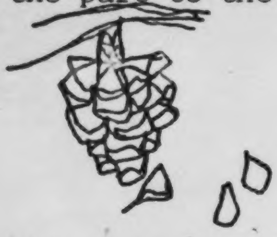
BIOLOGICAL SCIENCES

4. Show what the cone, scales, and seeds are on this picture by drawing an arrow from the part to the word.

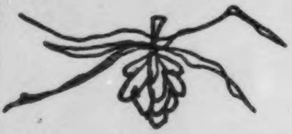
Cone

Scales

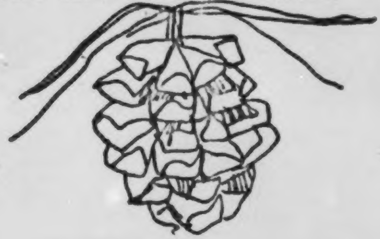
Seeds



5. Below are pictures of two cones: a female seed cone and a male pollen cone. Write the correct name under each.



____



____

6. Below is a list of 5 animals. Place an X next to the amphibians. (Ans.: 3,4.)

___(1) Alligator
___(2) Cotton-mouthed moccasin
___(3) Bull frog
___(4) Salamander
___(5) Horned lizard (horned toad)

7. Which of the animals below would you expect to find in a reptile house in a zoo? Place an X next to the reptiles. (Ans.: 1, 3, 5, 7.)

___(1) Box turtle
___(2) Frog
___(3) Horned lizard
___(4) Salamander
___(5) Diamond-back terrapin
___(6) Black bass
___(7) Garden snake
___(8) Shark
___(9) Seal
___(10) Great horned owl

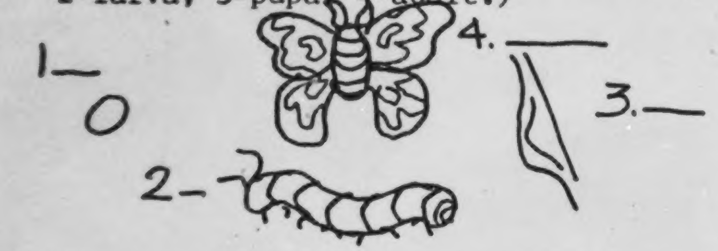
8. You find yourself in a strange land which is only inhabited by one species of mammal. This mammal stands erect on two legs with its head held high to take advantage of its binocular vision. It has the full use of two arms and its skull has the largest area to house its brain for its size. What is the name of this mammal.

______________ (Ans.: human or man.)

S

BIOLOGICAL SCIENCES

9. Below is a drawing of the stages of the life cycle of a silk worm. Label each stage with its name. (Answers: 1-egg, 2-larva, 3-pupa, 4-adult.)

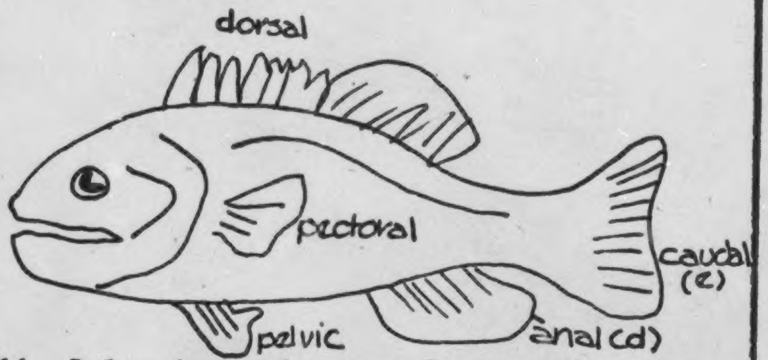


10. Fins of fish are used for different things. Below are some things that fins are used for. Match the fins to the things they are used for.

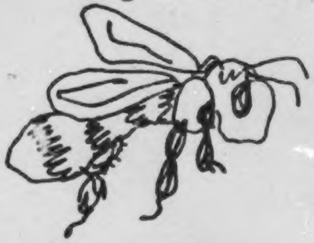
_____(1) acts as a steering device while fish is swimming
_____(2) acts to make fish swim fast
_____(3) acts like oars when fish is swimming slowly
_____(4) acts for balance when fish is is swimming
_____(5) acts for balance when fish is not swimming

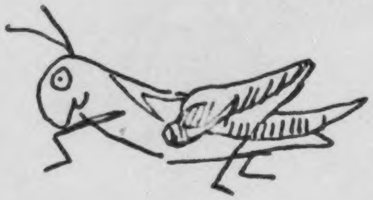
(Answers: 1. B-C, 2. E, 3. B, 4. A-D, 5. A-D-E.)

10. (continued).



11. Below is a picture of a grasshopper and a honeybee. Both have leg modifications. Describe what the modification is and tell why it is modified in that way. (Answers: The hind legs of the grasshopper are enlarged so that it can jump, and the hind legs of the honeybee are enlarged so that it can carry pollen.)





GRADE TWO ASSESSMENT ITEMS

2:12-16

BIOLOGICAL SCIENCES

12. Frogs have hind legs which are muscular to allow them to jump long distances on land. Their hind legs are also adapted in some way to allow them to swim in the water. How are they adapted to help frogs swim? (The hind legs of a frog have webbed toes to help them swim.)

13. Choose from the behaviors listed below those that are inborn (instinct) and those that are learned by placing an I for instinct and an L for those that are learned. (Answers: 1. L, 2. I, 3. I, 4. L, 5, I.)

___(1) A bear turns over a log to eat grubs.
___(2) A mosquito lays eggs in the water.
___(3) Salmon leave the ocean to go up a river.
___(4) A 2 month old baby smiles at his mother.
___(5) Young ducks swim.

14. Living animals depend on other living things for food is a fact that scientists have found is true for most animals. If you were a robin, check from this list the living things you would eat. (Answers: a, d, e, f.)

__a. worm
__b. gravel
__c. water
__d. seeds
__e. grasshopper
__f. berries

15. You have been selected with 21 other individuals to be the crew on the first space flight to the planet Venus. This flight will take many months just one way. Your trip begins and the 21 of you are busy doing your special jobs. One member of the crew complains that he doesn't feel very well, and the doctor aboard the space ship finds out that the crewman has brought aboard a case of measles. Strangely, no one aboard the spaceship had ever had the measles, and within 3 weeks everyone had the measles. State 3 ways that all the members on the spaceship could have caught the measles from the crewman who brought the disease aboard.

16. Circle the things man needs and underline the things man wants. (Answers: Needs-2, 4, 7, 9, 10, 12; Wants-1, 3, 5, 6, 8, 11.)

(1) fast cars
(2) air
(3) toys
(4) heat
(5) bicycle
(6) swimming pool
(7) water
(8) pretty clothes
(9) friends
(10) shelter
(11) candy
(12) food

PHYSICAL SCIENCES

17. Provide 3 blank index cards, capped and labeled vials of 8 materials to include at least 2 solids (e.g., oleo and sugar), 2 liquids (e.g., vinegar and cooking oil) and 2 gases (e.g., air and perfume). Say: Label your 3 index cards with one of the states of matter. Each of the vials you have been given contains a material which you may observe by looking, smelling, and touching. Decide which state of matter each vial contains and place the vial on one of the cards you have labeled.

18. Provide a demonstration of two balloons of equal size, inflated with the same amount of air and placed on an equal-arm balance. (Since it is very difficult to obtain two balloons of equal weight, it is suggested that the balance be zeroed after the balloons are placed on the balance to compensate for these inequalities.) Say: You see before you that the two balloons on this balance are equal in weight. I will prick one of the balloons with this pin. (Practice holding the balloon while making a pinhole to allow the air to slowly escape and avoid an explosion.) The scale now shows that these balloons are no longer in balance. Explain why this has happened.

19. Provide a container of water and several solid objects that will submerge. Say: You have a container of water and several solid objects. You will note that the water level is clearly marked on the outside of the container. Put all of the objects in the water but observe the water level before and after each object is added. Each time a different solid object was added to the container of water, the water level got higher. Why might I expect the water level to rise more if other solids are added to it? (Solids take up space used by the water and the water moves upward in the container.)

20. Provide a block of wood, a smooth surface such as a desk top, and a rough surface such as a long piece of sand paper. Say: Here is a block of wood. I want you to move the wood over this smooth surface and with the same force move the wood over this rough surface. Why is it easier to move the wood over the smooth surface than over the rough surface? (The rough surface produces a greater frictional hindrance to oppose motion than the smooth surface.)

GRADE TWO ASSESSMENT ITEMS

2:21-25

PHYSICAL SCIENCES

21. Provide a marked meter stick and objects that project shadows approximately 1 dm., 2 dm., and 3 dm. respectively such as a ruler, pencil, stick stuck in the ground, etc. Say: Three shadows are being made by the 3 objects. Measure the length of each shadow to the nearest decimeter.

22. (Teacher Note: Read orally each exercise.) Some objects can be identified by their sound. I have given you drawing materials. I have four objects that I want you to draw, but first close your eyes and listen as I drop each one to the floor. (Provide four objects such as a penny, a chalkboard eraser, a book, and a pencil. Drop the first object and remove it from students vision.) Now having just listened to the sound the object makes when it hits the floor, draw a picture of what you think the object is. (Repeat exercise for second, third, and fourth objects.)

23. Provide a demonstration of pushing 2 boxes, one empty and one containing objects such as books. Say: You have watched me push these two boxes. This box is empty and this one contains objects. (Name the objects.) Point to the box you think must have the most force to move it.

24. Provide each student with two containers of water at different but known temperatures, such as an ice-water mixture and a container of water at room temperature. Also provide a thermometer. Say: You have been given two containers of a liquid and a thermometer. Measure and report the temperatures of the two liquids.

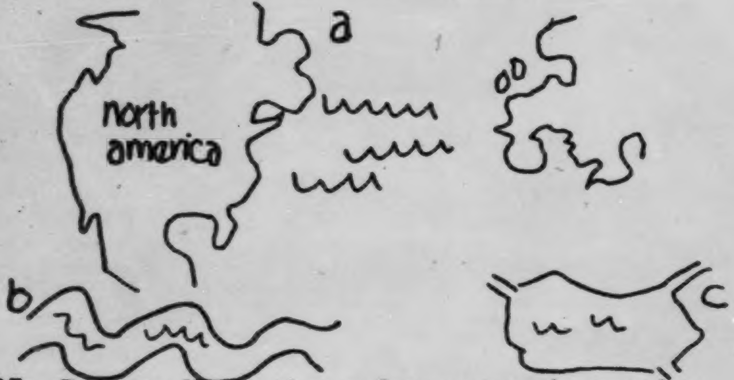
25. (Teacher Note: Read each exercise orally.) Listen to the following situation. I have some dry instant flavoring that I want to mix with water. I will put one teaspoonful in a cup of cold water and stir. I will put one teaspoonful in a cup of hot water and stir. Now, tell me, in which cup will the coffee mix faster? Explain your choice. (Use instant coffee, cocoa, etc.) (The instant flavoring mixes faster in hot water because heat facilitates the process of mixing.)

GRADE TWO ASSESSMENT ITEMS

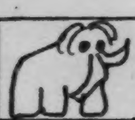
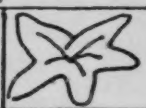
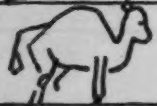
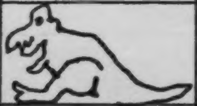
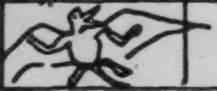
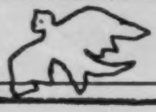
2:26-29

EARTH-SPACE SCIENCES

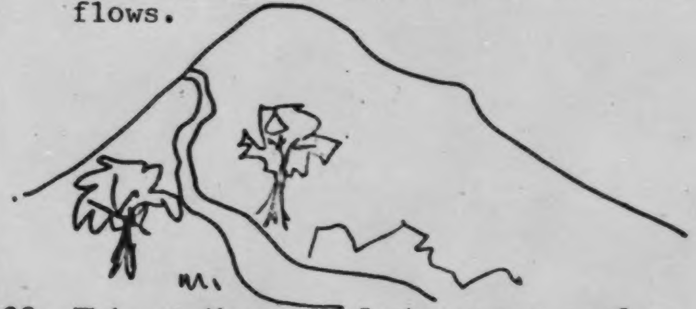
26. Here are three pictures of bodies of water. Put the name under each for the river, the lake, the ocean.



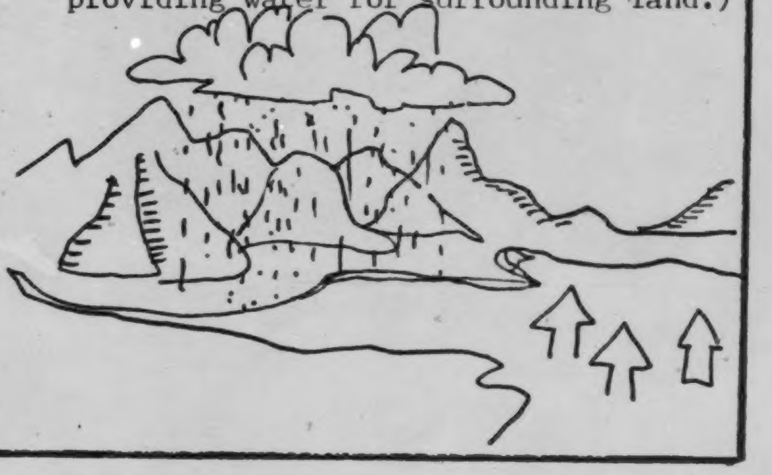
27. Put an X in the column you choose by each picture for those kinds of animals that are still living today and those that are no longer living today.

	EXISTS TODAY	NO LONGER EXISTS		EXISTS TODAY	NO LONGER EXISTS
					
					
					

28. Mark on this drawing with an arrow showing the direction that the water flows.



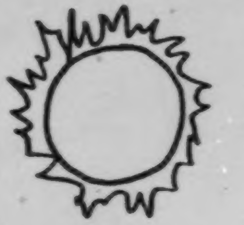
29. This a diagram of the water cycle. What part does the lake play in the water cycle? (Lakes are storage basins for large amounts of water providing water for surrounding land.)



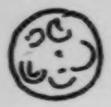
2:30-31

GRADE TWO ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

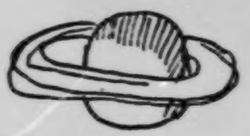
30. The illustration shows three bodies found in the solar system. Place an X below the one that is a satellite of the earth. (Answer: B.)



A.______

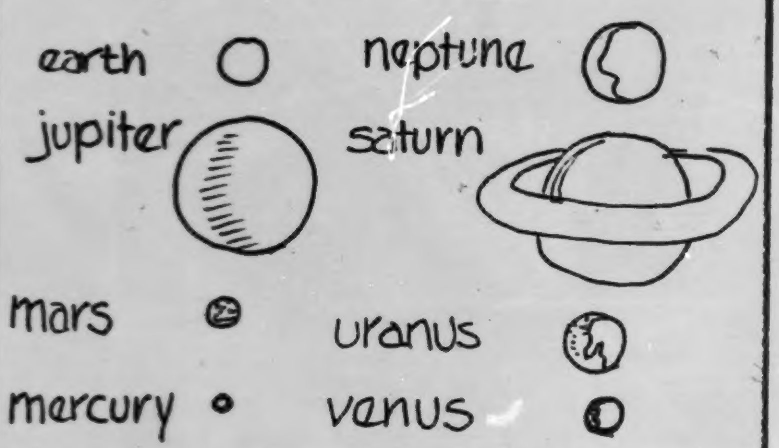


B.______



C.______

31. The sizes of the planets compared to one another are shown in the diagram. Place the planets into two groups based on your observations of their sizes. Place an X next to the planets you place in one group according to their size. Do not mark the planets in the other group.


earth
neptune
jupiter
saturn
mars
uranus
mercury
venus

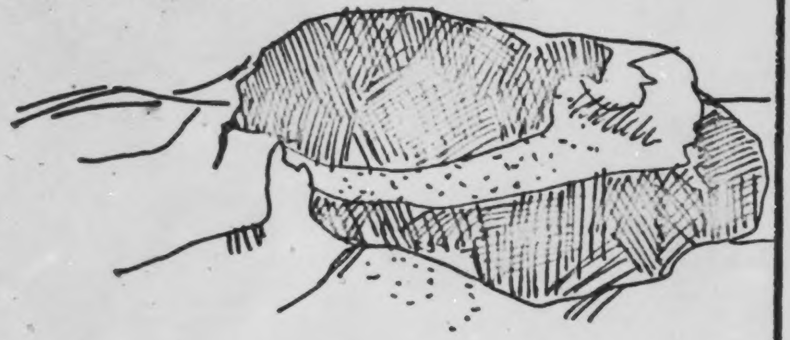
GRADE TWO ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

2:32-35

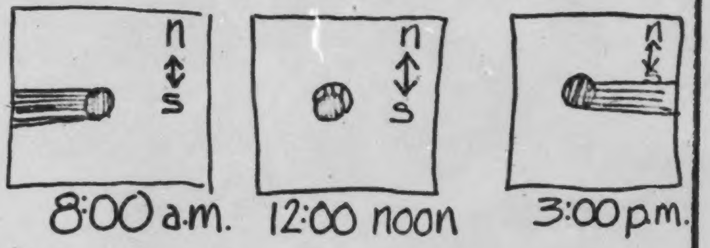
32. In your own words, state the meaning of the word planet. (A planet is a celestial object that orbits a sun and does not produce its own light.)

33. Jupiter has 12 satellites. What is a satellite? (A satellite is an object that orbits a planet.)

34. Examine the crater shown in the illustration. After your examination, draw an arrow next to the crater to show the direction from which you think the sunlight is coming. (The direction of sunlight can be inferred as coming from the side opposite the shadow.)



35. Here are 3 drawings looking down at a stick set into the ground on a sunny day. The drawings were done at 8:00 a.m., 12:00 noon, and 3:00 p.m. Each is labeled. During the drawing, the artist always stood in the same position. Describe 2 changes of the shadow during the day. (The shadows change in length and position.)



GRADE THREE OBJECTIVES

3:1-8

BIOLOGICAL SCIENCES

1. **Variety & Pattern (Plants)-Classifying**

   Given a list of food plants, the student will be able to identify the part of the plant used for food. (asparagus, carrot, mustard, tomato, celery, beet, spinach, orange, potato, onion, etc.)

2. **Variety & Pattern (Plants)-Inferring**

   Given several types of grasses, the student will be able to generate an inference that indicates that all grasses have jointed stems, long, thin, pointed blades, and that the bottom of the blade is wrapped around the stem.

3. **Variety & Pattern (Plants)-Classifying**

   Given plants with taproots (e.g., beets, carrots, turnips) and plants with fibrous roots (e.g., grass, corn, clover), the student will be able to classify the characteristics of the taproot (e.g., large, central fleshy, generally edible) and the fibrous root (e.g., many roots of the same size, small roots).

4. **Variety & Pattern (Plants)-Classifying**

   The student will be able to identify the grafting function shown in pictures by stating that a tree is being grafted onto another.

5. **Variety & Pattern (Plants)-Inferring**

   Given a drawing of a plant stem placed in water, the student will be able to apply the concept that some plants will root under these conditions. (geranium, coleus, sultana, etc.)

6. **Variety & Pattern (Plants)-Classifying**

   Given at least five leaf pictures or leaves from a variety of plants, the student will be able to identify the leaf veins as the structure involved in transporting liquids through the plant.

7. **Variety & Pattern (Animals)-Classifying**

   Given a list of different type bone joints, the student will be able to identify examples of them in the human body.

8. **Variety & Pattern (Animals)-Measuring**

   Given an insect and a metric ruler, the student will be able to state the length of each body part to the nearest millimeter.

GRADE THREE OBJECTIVES
BIOLOGICAL SCIENCES

3:9-18

9. Variety & Pattern (Animals)-Classifying

The student will be able to describe an experiment to test the hypothesis that insects grow only during the larva stage if they undergo complete metamorphosis.

10. Variety & Pattern (Animals)-Inferring

The student will be able to apply the concept of regeneration as it applies to amphibians by stating that the ability to grow new parts will occur and that the animal will continue to function.

11. Variety & Pattern (Microbes)-Classifying

Given a list of substances found in a kitchen, the student will be able to identify those which will be good food sources for molds.

12. Survival & Adaptation-Inferring

Given life cycles of animals, the student will be able to depict the stages of another animal.

13. Survival & Adaptation-Inferring

Given the fact that in a competitive and crowded environment only the fittest survive, the student will be able to generate meaning for the term "fittest".

14. Survival &Adaptation-No Process

The student will be able to recall the definition of migration.

15. Interaction & Interdependence-Communicating

The student will be able to choose any natural community and present a report on that community to the class. (The report should emphasize the dominant animals and plants.)

16. Interaction & Interdependence-Classifying

Given a list of plant communities, the student will be able to identify those supporting a greater variety of animal life.

17. Continuity & Change-Communicating

Given a list of endangered animal species and a statement that they are being killed never to be seen again by man, the student will choose to speak in favor of protecting the animals.

18. Continuity & Change-No Process

Given a list of plants, the student will be able to classify the plants needing man's cultivation for survival.

GRADE THREE OBJECTIVES
PHYSICAL SCIENCES

3:19-26

19. Matter-Communicating

Given a set of blocks, the student will be able to generate a bar graph of the blocks by color.

20. Matter-Communicating

Given samples of salt (NaCl) and sugar crystals and a magnifier and asked to distinguish their similarities and differences, the student will be able to describe them by constructing a list of similar and dissimilar characteristics.

21. Matter-Measuring

Given a metric ruler and a diagram of labeled points, the student will be able to use the ruler to measure and report the distance between three pairs of points.

22. Matter-Inferring

Given a demonstration of blowing air into an inverted container, the student will be able to generate an inference that air takes up space, causing the water level to go down.

23. Matter-Interpreting Data

Given a graph of melting times for four and eight ice cubes, the student will be able to generate an interpolation and extrapolation by stating the time it takes for seven and two cubes to melt.

24. Matter-Measuring

Given containers, sand, pebbles, a sieve, and water, the student will be able to manipulate the sieve, separating the solids from the water.

25. Matter-Formulating Hypotheses

Given a demonstration in which a candy ball (e.g., lemon flavored and colored) is placed in a container of water, information about interaction, and asked to list evidence of interaction, the student will be able to construct a list citing observable changes in the mixture.

26. Energy & Force-Inferring

Given examples of energy changes, the student will be able to state orally that energy can be changed from one form into another form. (wind to waving flag, chemical energy in dry cell to mechanical energy, sun energy to electrical energy for a satellite)

GRADE THREE OBJECTIVES

PHYSICAL SCIENCES

3:27-29

27. Energy & Force-Inferring

The student will be able to identify the type of energy required to work several objects in a state of rest. (pencil sharpener, spring or battery operated toy, electrical record player, etc.)

28. Matter-Energy Changes-Using Space/Time Relationships

The student will be able to use a reference frame made of a grid of squares with a vertical axis of A through G and a horizontal axis of 1 through 6 to locate position.

29. Matter-Energy Changes-Using Space/Time Relationships

Given a labeled dot grid and asked to graph motion, the student will be able to trace the path of a moving object when directions for distance and direction are given.

GRADE THREE OBJECTIVES
EARTH-SPACE SCIENCES

3:30-37

30. **Earth-Classifying**

The student will be able to classify a group of rocks on one observable characteristic. (size, shape, color, texture, etc.)

31. **Earth-No Process**

Given the task of making an initial collection of rocks or shells, the student will show an interest in rocks or shells. (brings in rocks, reads related books, tries to interest others, talks about rocks, etc.)

32. **Water-Inferring**

Given diagrams of containers indicating the mixing of cold and warm water, the student will be able to state that the cold water will sink below the warmer water.

33. Given diagrams of young, mature, and old rivers, the student will be able to classify the young as having a deep V with broad flatlands between, a mature river as less steep sided, and an old river as meandering and flat banked.

34. **Air-Interpreting Data**

Given two diagrams of a thermometer in a liquid before and during heating, the student will be able to apply the concept that most substances expand when heated.

35. **Air-Interpreting Data**

Given weather information, the student will be able to apply the concept of variations of atmospheric pressure and related weather. (Observation of sky condition, temperature, and wind speed results in estimate of atmospheric pressure.)

36. **Air-Interpreting Data**

Given diagrams showing the transfer of air from one jar to another under water, the student will be able to apply the concept that air is a real substance.

37. **Air-No Process**

Given two diagrams of a pyrex bottle, balloon, and a heat source, the student will be able to apply the concept that warmed air expands and cooled air contracts.

GRADE THREE OBJECTIVES
EARTH-SPACE SCIENCES

38. Space-Observing

Given a picture of Saturn, the student will be able to write a description of the planet.

39. Space-Inferring

Given a drawing of a galaxy, the student will be able to state that it is a galaxy or a collection of stars.

LEVEL: GRADE THREE

CONTENT: Biological Sciences
Variety & Pattern (Plants)

PROCESS: Classifying

3.1

IDENTIFYING EDIBLE PARTS OF PLANTS

OBJECTIVE #1

Given a list of food plants, the student will be able to identify the part of the plant used for food.

ASSESSMENT #1

Match the food plant to the part of the plant providing the food.

1. asparagus
2. carrot
3. mustard
4. tomato
5. celery
6. beet
7. spinach
8. orange
9. potato
10. onion

A. fruit
B. stem
C. leaf
D. root
E. seed

(1-B, 2-D, 3-E, 4-A, 5-B, 6-D, 7-C, 8-A, 9-B, 10-C)

RELATED ACTIVITY

Teacher Information:
People do not eat the whole plant. Other parts may taste good and be nutritionally wholesome, but custom has lead us to believe that only some parts of plants are good for us.

Procedure:
1. Discuss with students the parts of plants that we eat.
2. Divide the class into four groups. One group looks up information in books about those plants which provide food in the form of seeds, the second group on roots, the third group on stems, and the fourth group on leaves.
3. After the information is gathered, each group presents its findings to the rest of the class.
4. The information is organized in the form of a retrieval chart. (See sketch.)
5. Generalize about the findings.

MATERIALS

pictures of foods representing plant parts:
- a. Roots: carrots, radishes, beets, turnips, etc.
- b. Stems: asparagus, celery, etc.
- c. Seeds: corn, oats, wheat, rice, etc.
- d. Leaves: lettuce, spinach, cabbage, etc.
- e. Fruit: oranges, grapes, etc.

(Retrieval Chart)
DESCRIBING EDIBLE PLANTS

	CARROTS	. . .
ROOTS		
STEMS		
LEAVES		
SEEDS		
FRUIT		
FAMILY		
FOOD VALUE		

LEVEL: GRADE THREE

CONTENT: Biological Sciences

Variety & Pattern (Plants)

PROCESS: Classifying

3:4

GRAFTING PLANTS

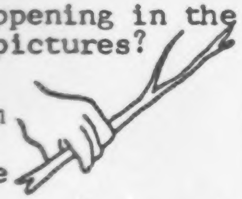
OBJECTIVE #4

The student will be able to identify the grafting function shown in pictures by stating that a tree is being grafted onto another.

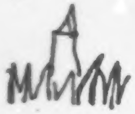
ASSESSMENT #4

What is happening in the following pictures?

a.
branch from
seedless
orange tree



b.
root of
lemon tree

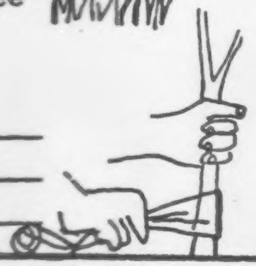


c.

____

____

____



RELATED ACTIVITY

Teacher Information:
Grafting is a way that man has improved plants and learned to use them for his benefit.

Procedure:
1. Graft plants only in the winter or spring when the plants are dormant.
2. The stock (base plant) and the cion (part of another plant to be grafted) should belong to the same species.
3. Select only strong, healthy plants free from apparent disease.
4. Cover the joined parts with wax and wrap securely to prevent water loss and to keep the cion in place.

MATERIALS

base plant
part of another plant
of the same species
to be grafted
wax
cloth
aluminum foil

LEVEL: GRADE THREE

CONTENT: Biological Sciences
Variety & Pattern (Microbes)

PROCESS: Classifying

3:11

GROWING MOLD

OBJECTIVE #11

Given a list of substances found in a kitchen, the student will be able to identify those which will be good food sources for molds.

ASSESSMENT #11

Which of these substances found in a kitchen would be good to grow mold?

_____1. bread
_____2. wax
_____3. soap
_____4. orange
_____5. toothpick
_____6. grapes
_____7. jelly
_____8. sugar
_____9. beans
_____10. cheese

(Answer: 1, 4, 6, 7, 9, 10)

RELATED ACTIVITY

Teacher Information:
The students will find that molds need moisture, warmth, and darkness to grow. Bread mold will appear gray - minute white stalks with little black spore cases on the top ends. Some of the mold on the bread may be green. This could be penicillium. Take samples of the mold, place on glass slides, and observe them under a microscope. Discuss the economic importance of molds to man.

Procedure:

1. Rub slices of bread and other substances on a dusty surface such as the floor in order to pick up existing spores.
2. Sprinkle the bread and other substances with water and place in coffee cans.
3. Leave covered cans in both warm and cold locations and put at least one can, uncovered, in a light place for several days.

MATERIALS

coffee cans
slices of bread
other kitchen substances
covers for the cans
water

LEVEL: GRADE THREE

CONTENT: Physical Sciences

Matter

PROCESS: Inferring

3:22

PROVING THAT AIR OCCUPIES SPACE

OBJECTIVE #22

Given a demonstration of blowing air into an inverted container, the student will be able to generate an inference that air takes up space, causing the water level to go down.

ASSESSMENT #22

Watch what happens when I blow air into this straw. What inference can you make to explain why the level of water in the inside container has gone down?

(Answer: Air takes up space and displaces the water.)

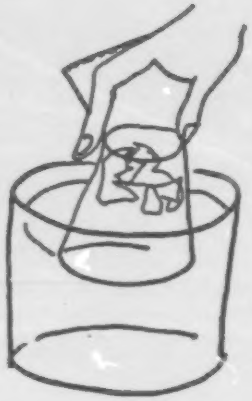
RELATED ACTIVITY

Teacher Information:
Air is a real substance and occupies space. The tumbler is full of air and no water can enter it unless some of the air is removed.

Procedure:
1. Partly fill a large glass jar with water.
2. Crumple a sheet of paper into a ball and stuff it into a glass tumbler.
3. Invert the tumbler and completely submerge it in the jar of water.
4. Take the tumbler out of the water and remove the paper. (The paper will be dry.)

MATERIALS

large glass jar
glass tumbler
paper
water



LEVEL: GRADE THREE

CONTENT: Physical Sciences

Matter

PROCESS: Inferring

3:22

SHOWING THE SPACE OCCUPIED BY AIR

OBJECTIVE #22

Given a demonstration of blowing air into an inverted container, the student will be able to generate an inference that air takes up space, causing the water level to go down.

ASSESSMENT #22

Watch what happens when I blow air into this straw. What inference can you make to explain why the level of water in the inside container has gone down?

(Answer: Air takes up space and displaces the water.)

RELATED ACTIVITY

Procedure:

Part A

1. Wet the stem of a glass funnel and insert it into a 1-hole stopper.
2. Fit the stopper tightly into a flask.
3. Pour the water into the funnel. (The water does not flow through the funnel.)

Part B

1. Insert the funnel into one hole of a 2-hole stopper.
2. Insert a bent glass tube into the other hole of the stopper.
3. With a rubber band or a piece of string, fasten a toy balloon to the open end of the bent glass tube.
4. Pour water into the funnel. (The water flows through the funnel and the balloon becomes inflated.)

MATERIALS

glass funnel

1-hole rubber stopper

2-hole rubber stopper

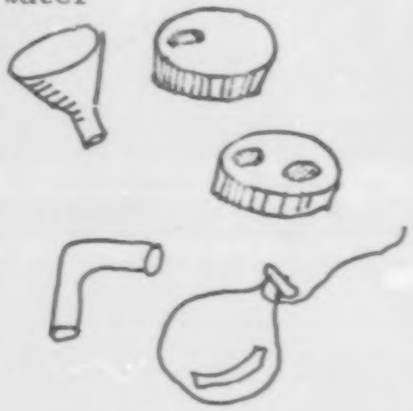
flask

short glass tube bent at a right angle

toy balloon

rubber band or string

water



LEVEL: GRADE THREE

CONTENT: Physical Sciences
Energy & Force

PROCESS: Inferring

3:26

LIVING WITH SUN POWER

OBJECTIVE #26

Given examples of energy changes, the student will be able to state orally that energy can be changed from one form into another form.

ASSESSMENT #26

Listen to these statements:

a. Gravitational energy in wind can be changed to wave a flag.
b. Chemical energy in a dry cell battery is changed to move a toy car.
c. Sun energy is changed to electrical energy to run a satellite.
d. Chemical energy in gasoline is changed to mechanical energy to run an automobile.

What idea about energy does all these have?

RELATED ACTIVITY

This activity requires a classroom with windows facing on the east, west, or south side. The sunlight must enter at least in the morning or afternoon, while the students are in attendance. Students should collect metal containers of every shape and size they can find. They should paint the outside of these flat black.

Procedure:

1. Fill the metal containers nearly to the top with water.
2. Place the containers of water in the sunlight.
3. Every 15 minutes a student should take the temperature of the air in the room and the water temperature in the cans. (Thermometer should be calibrated up to 100 degrees centigrade.)
4. Students should record the information in both table and graph form. (See sketch.)
5. Generalize about the collection and storing of solar energy.

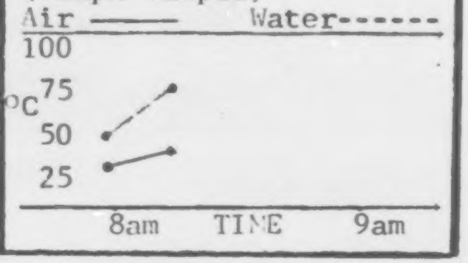
MATERIALS

a collection of various sizes and shapes of metal cans
black, flat paint
water
room thermometer
thermometer that is calibrated up to 100 degrees centigrade
paper for graphing
writing instrument

(Sample Reading)(in ^{o}C.)

Time	Air	Water
8:00	30	50
8:15	34	75

(Graph Sample)



LEVEL: GRADE THREE

CONTENT: Earth-Space Sciences

Air

PROCESS: Interpreting Data

3:34

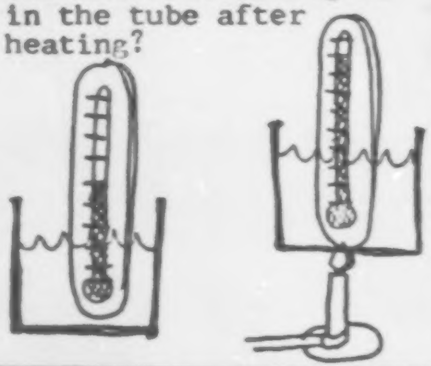
DESCRIBING THE EFFECT OF HEAT ON GASES

OBJECTIVE #34

Given two diagrams of a thermometer in a liquid before and during heating the student will be able to apply the concept that most substances expand when heated.

ASSESSMENT #34

The two thermometers show a thermometer before and after heating. Why is the liquid in the thermometer higher in the tube after heating?



RELATED ACTIVITY

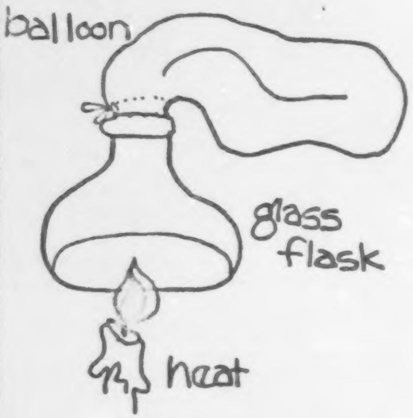
Teacher Information:
Gases expand when heated, contract when cooled.

Procedure:
1. Place a balloon over the top of a glass flask.
2. Heat the glass flask slowly until balloon is inflated.
3. Set flask aside to cool. Note change in shape of balloon.

Questions:
1. Will the balloon expand more if a larger glass flask is used?
2. When the balloon is expanded, if the flask is placed in cold water, will the balloon contract?
3. If a nut is stuck on a bolt, will heating the nut help to remove it?

MATERIALS

glass flask
rubber toy balloon
string or rubber band
heating apparatus



LEVEL: GRADE THREE

3:34

CONTENT: Earth-Space Sciences
Air

PROCESS: Interpreting Data

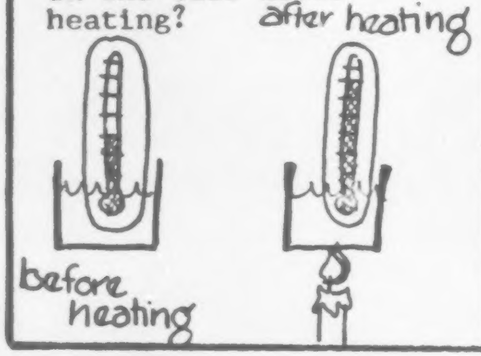
DESCRIBING THE EFFECT OF HEAT ON VARIOUS SUBSTANCES

OBJECTIVE #34

Given two diagrams of a thermometer in a liquid before and during heating the student will be able to apply the concept that most substances expand when heated.

ASSESSMENT #34

The two diagrams show a thermometer before and after heating. Why is the liquid in the tube higher in the tube after heating?



RELATED ACTIVITY

Teacher Information:
Most metals expand when heated. In the case of this wire, it becomes longer when heated.

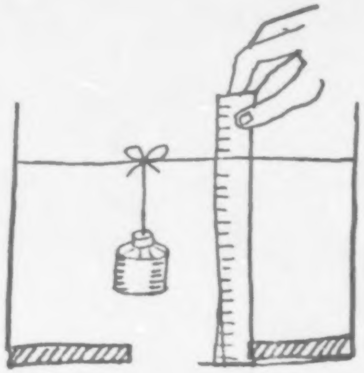
Procedure:
1. Stretch a wire between two points.
2. Tie a weight in the center of the wire.
3. Measure the distance from the wire to the table.
4. Use a heating apparatus to heat the wire.
5. Move the burner back and forth along the wire so that the wire becomes heated throughout its entire length.
6. Measure the distance from the wire to the table again.

Results:
When the wire is heated, the weight draws it closer to the table.

Questions:
Do telephone lines sag more on a hot day?

MATERIALS

piece of uninsulated iron or copper wire
weight
ruler
2 stands or points to which wire can be stretched
heating apparatus (gas burner perferred)



GRADE THREE RELATED MATERIALS 3:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
1. Classifying plants according to edible parts.	IDENTIFYING EDIBLE PARTS OF PLANTS	2:12-15	Pt. 6: 47-55	4:354-381		
2. Inferring the characteristics of grasses.						
3. Classifying the characteristics of taproots and fibrous roots.				5:21-32		
4. Identifying the grafting function.	GRAFTING PLANTS					
5. Recalling that some plants root when stem is placed in water.			Pt. 4: 103-107			
6. Identifying leaf veins as involved in transporting plant liquids.						
7. Classifying different types of bone joints in the human body.		4:102-107				

GRADE THREE RELATED MATERIALS

3:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
8. Describing the length of insect body parts in millimeters.		3:17				
9. *Describing how to determine when insects grow.		2:35-40				
10. Inferring the concept of regeneration in amphibians.						
11. Identifying good kitchen food sources for mold growth.	GROWING MOLD		Pt. 5: 119-125	4:55-61		
12. Depicting the life cycles of animals.		2:35-44 2:137 2:144 2:148	Pt. 7: 61-72			
13. Inferring the meaning of the term "fittest".						
14. Recalling the definition of migration.		2:31 2:45 2:136-139				

GRADE THREE RELATED MATERIALS 3:15-21

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
15. Describing the dominant animals and plants in a community.		3:182-210	Pt. 4: 147-152			
16. Identifying the plant community supporting a variety of life.						
17. Choosing to speak in favor of protecting animals.						
18. Classifying plants needing man's cultivation to survive.						
19. Generating a bar graph of blocks by color.						
20. Describing the characteristics of crystals.		2:115-117		3:40-49 5:127-139		
21. Measuring the distance between three pairs of points.		2:46-57 3:9-10	Pt. 4: 141-145			

GRADE THREE RELATED MATERIALS 3:22-27

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
22. Inferring that air takes up space.	PROVING THAT AIR TAKES UP SPACE	3:128-129	Pt. 4: 81-85			
	SHOWING THE SPACE OCCUPIED BY AIR					
23. Graphing the melting times of ice cubes.		2:69 3:19 3:166-167		3:227-246 4:22-31 4:76-85		
24. Using a sieve to separate solids from water.			Pt. 4: 95-99 Pt. 3: 175-179	3:28-39 4:253-281 5:65-83		
25. Describing the interaction of a solid and a liquid.		2:104-111		3:40-61 3:273-295		
26. Inferring that energy is changed from one form to another form.	LIVING WITH SUN POWER			3:73-77 3:202-205 5:204-258		
27. Identifying the type of energy required to operate objects.		2:83-101	Pt. 5: 69-95	3:78-84 3:175-201		

GRADE THREE RELATED MATERIALS

3:28-33.

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
28. Utilizing a reference frame made of a grid of squares.		3:50-57		3:96-107 3:126-165 3:247-264		
29. Graphing the path of a moving object.		3:56-57				
30. Classifying rocks according to an observable characteristic.						
31. Showing an interest in rocks or shells.						
32. Inferring that cold water will sink below warmer water.				4:173-209		
33. Classifying diagrams as that of young, mature, and old rivers.		4:38-39				

GRADE THREE RELATED MATERIALS

3:34-39

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
34. Indicating that most substances expand when heated.	DESCRIBING THE EFFECT OF HEAT ON GASES	3:154-155				
	DESCRIBING THE EFFECT OF HEAT ON SUBSTANCES					
35. Describing atmospheric pressure and related weather.						
36. Indicating that air is a real substance.						
37. Recalling that warmed air expands and cooled air contracts.		3:133-143				
38. Writing a description of Saturn.						
39. Identifying a picture of a galaxy.						

GRADE THREE ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

1. Match the food plant to the part of the plant providing the food.

___(1) asparagus
___(2) carrot
___(3) mustard
___(4) tomato
___(5) celery
___(6) beet
___(7) spinach
___(8) orange
___(9) potato
___(10) onion

A. fruit
B. stem
C. leaf
D. root
E. seed

(Answers: 1-B, 2-D, 3-E, 4-A, 5-B, 6-D, 7-C, 8-A, 9-B, 10-C.)

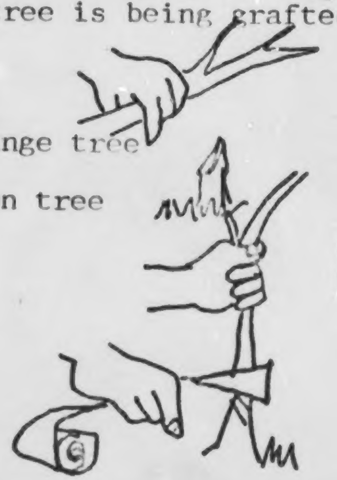
2. Provide three types of grass such as oats, corn, and rye. Say: Here are three types of grass. What are the characteristics you see which are common to all grasses? (Characteristics must include that grasses have jointed stems, long, thin, pointed blades, and the bottom of the blade is wrapped around the stem.)

3. Examples of taproots are turnips, carrots, and dandelions. Examples of fibrous roots are grass, wheat, and clover. Place a "T" before the characteristics of a taproot and an "F" before the characteristics of a fibrous root system.

___(1) has a large central root
___(2) main root is fleshy
___(3) has many roots of the same size
___(4) roots are small and there are many of them

(Answers: 1-T, 2-T, 3-F, 4-F.)

4. What is happening in the following pictures? (A tree is being grafted onto another.)



a. branch from seedless orange tree

b. root of lemon tree

c. ____________
____
____
____
____

GRADE THREE ASSESSMENT ITEMS

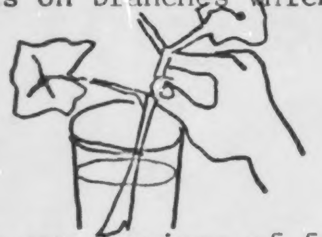
3:5-8

BIOLOGICAL SCIENCES

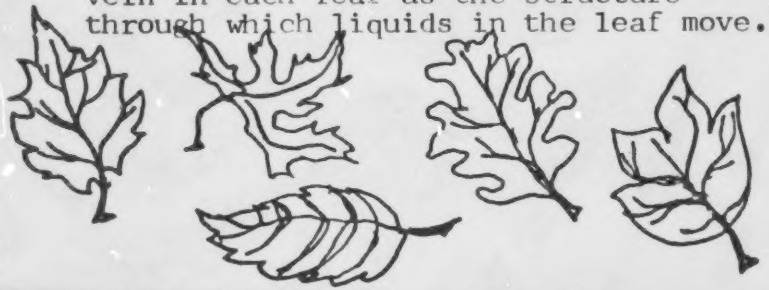
5. Look at this picture of the geranium stem in a glass of water. Check what will probably happen to the stem.

___(1) It will die.
___(2) It will grow roots.
___(3) It will turn purple.
___(4) It will live.

(Answers: 2, 4.) (Some plants can form roots on branches which have been cut.)



6. Here are drawings of five leaves. Draw a line to the areas on the plant which have to do with liquid movement in the leaves. (The student identifies the vein in each leaf as the structure through which liquids in the leaf move.)



7. Match the bone joint found in the body with examples of where they are found.

TYPE OF JOINT

___(1) hinge
___(2) ball & socket
___(3) angular
___(4) gliding
___(5) pivot

A. wrist joint
B. head attachment to backbone
C. knee joint
D. between vertebrae in backbone
E. hip joint

(Answers: 1-C, 2-E, 3-A, 4-D, 5-B.)

8. Provide an adult grasshopper specimen. Say: Here is a grasshopper. Measure and record the length of each of the following parts:

____________(1) head
____________(2) thorax
____________(3) abdomen

(Measurements should be expressed in metric terms to the nearest millimeter.)

GRADE THREE ASSESSMENT ITEMS

BIOLOGICAL SCIENCES

9. A scientist observed a silk worm and a housefly during their life cycles and generated the following hypothesis. Insects grow in size only during their larva stage if they undergo complete metamorphosis. As a scientist you wish to gather some more data to see if the data do or do not support this hypothesis. Write a description of an experiment you would do to gather the data. (The experiment must include: (1) an insect which undergoes complete metamorphosis and (2) observing and measuring the insects during periodic time intervals through all stages of the life cycle.)

10. Imagine yourself as a baby frog in the tadpole stage of your development. As you are swimming around the pond in which you live with many other tadpoles, you observe some of the other tadpoles being attacked by a big black bass. As you watch, you see one of your friends try to get away, but the bass grabs him by the tail, and bites his tail off. Your friend, the tadpole, escapes from the bass but does not have a tail. What will happen to him? (Regeneration, the ability to grow new parts, will occur and the animal will continue to function.)

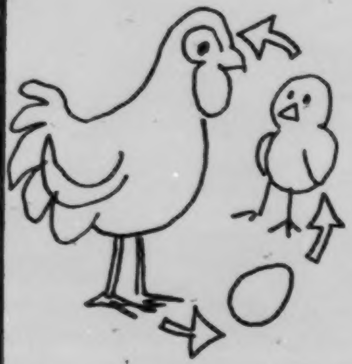
11. Check the items from this list of substances from the kitchen which would be good for mold growth.

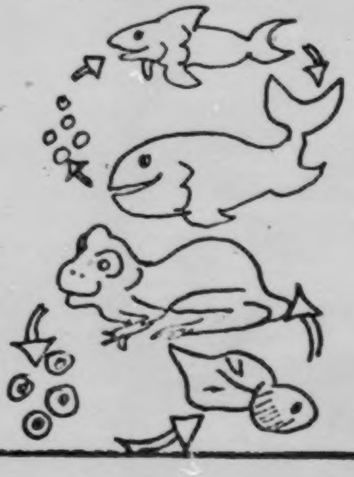
___(1) cake
___(2) wax
___(3) salt
___(4) apples
___(5) peas
___(6) spaghetti
___(7) potatoes
___(8) paper
___(9) soap
___(10) cucumbers

(Answers: 1, 4, 5, 6, 7, 10.)

12. The examples below illustrate life cycles of three animals. Choose one animal from the list and draw its life cycle.

A. shark
B. alligator
C. grasshopper
D. duck
E. salamander





GRADE THREE ASSESSMENT ITEMS 3:13-18
BIOLOGICAL SCIENCES

13. Every living organism faces great competition to survive in our crowded world. Only the fittest live. What do we mean by fittest? (The organism may be the: (1) strongest, (2) fastest, (3) smartest, (4) hardiest, (5) keenest senses, (6) fastest reproducer, (7) eats the widest variety of foods, (8) able to use man made structures. Explanation must include at least four of the above.)

14. What is migration? (Migration is the process by which animals travel from one place to another during certain yearly periods.)

15. Pick a natural community of your choice and report to the class your findings about the dominant animals and plants of that community and why you selected that particular community.

16. From a list of communities, place an X next to the one which would have the greatest variety in its animal population. (The more variety in plants in a community, the more variety there will be in the animals' population.)

___(1) a rice field
___(2) the Everglades
___(3) an orange grove
__(4) a downtown park
__(5) an over grown lot

___(1) a rice field
___(2) the Everglades
___(3) an orange grove
___(4) a downtown Miami park
___(5) an overgrown vacant lot
___(6) an untouched (virgin) forest

(Answer: #2.)

17. The bald eagle, blue whale, California's condor, Everglades kite, red wolf, key deer, cougar, alligator, and whooping crane are all species of animals in the U. S. which are endangered species. These animals may all be killed and may never be seen by man again. What should we do about these animals? (Response should be in favor of protecting the animals on the list and should include why.)

18. From this list of plants found in Florida, check the plants which depend mainly on man's cultivation for survival.

___(1) oak trees
___(2) cotton
___(3) pine
___(4) wheat
___(5) palm
___(6) soybeans
___(7) alfalfa
___(8) dandelions
___(9) bermuda grass
___(10) palmetto

(Answers: 2, 4, 6, 7.)

GRADE THREE ASSESSMENT ITEMS
PHYSICAL SCIENCES

19. Here are some blocks (set of blocks the same size with 2 blue, 4 yellow, and seven red). With this graph paper (marked in 2 cm squares) and these blue, yellow, and red crayons, make a bar graph showing the number of blue blocks, yellow blocks, and red blocks. (Graph must show a vertical and a horizontal axis with 2 square regions colored in blue, 4 square regions colored in yellow, and 7 square regions colored in red.)

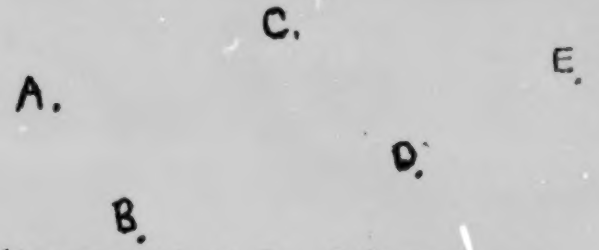
20. Provide samples of chemically pure salt (NaCl) and sugar crystals and a magnifier. Say: Observe the salt and sugar and list ways in which they are alike and different. (Description must include similarities in shapes of faces (e.g., squares and rectangles) and clarity and differences in angle at which faces are joined (e.g., right angle, acute angle, obtuse angle).

21. You have been given a metric ruler and a diagram with 6 labeled points. Measure the distance between the following points to the nearest 0.1 cm.

A to B_______________

C to D_______________

E to F_______________

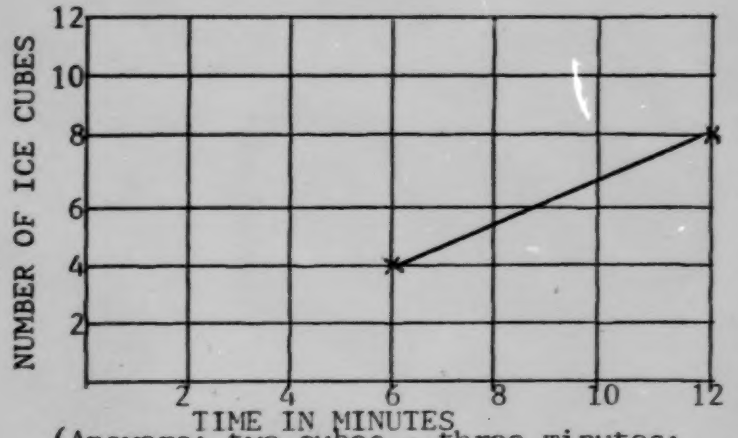


(Answers: A to B - 2.2 cm;
C to D - 2.6 cm;
E to F - 2.7 cm.)

22. Provide a demonstration of blowing air with a tube into an inverted container in colored water (the container should lie in a volume of colored water such that the mouth of the container is below the level of water it rests in). Say: Watch what happens when I blow air into this straw. What inference can you make to explain why the level of water in the inside container has gone down? (Answers: Air takes up space and displaces the water.)

GRADE THREE ASSESSMENT ITEMS
PHYSICAL SCIENCES

23. Using the graph, write down the times required to melt two ice cubes and seven ice cubes.



ICE CUBE MELTING TIME

(Answers: two cubes - three minutes; seven cubes - eleven mintes.)

24. You have been given a fine sieve and 4 beakers. Two of the beakers are empty. The third beaker is filled with sand and water, and the fourth is filled with pebbles and water. Using these materials, separate the sand and pebbles from the water. (The water from each beaker must be poured into each of the empty beakers by using the sieve.

25. Provide a demonstration in which a candy ball (e.g., lemon flavored and colored) is placed in a container of water. Say: I will put this candy ball in this container of water and stir it round and round. If one material changes another, they are interacting. Make a list of any evidence you can observe of these two materials interacting. (The list must include the yellowing of the water and the decreasing size of the candy ball.)

26. What idea about energy do all these statements have in common?

(1) Gravitational energy in wind can be changed to a waving flag.
(2) Chemical energy in a dry cell battery is changed to move a toy car.
(3) Sun energy is changed to electrical energy to run a satellite.
(4) Chemical energy in gasoline is changed to mechanical energy to run an automobile.

(Answer: Energy can be changed from one form to another.)

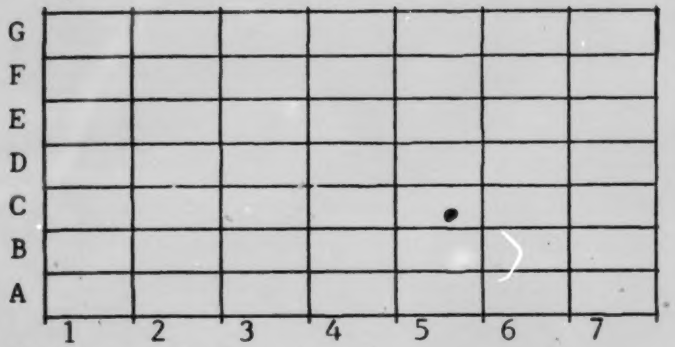
GRADE THREE ASSESSMENT ITEMS

PHYSICAL SCIENCES

3:27-29

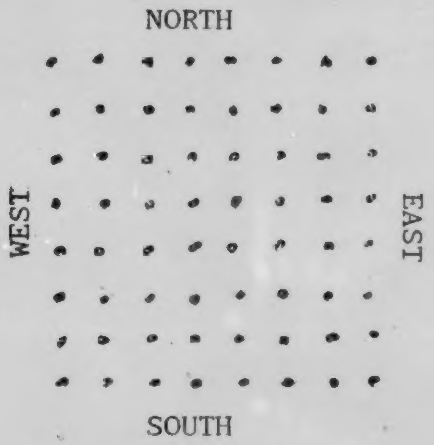
27. Here are some objects (a pencil sharpener, toy car, and a record player). All of these objects need a kind of energy to make them work. Name the kind of energy that makes each object work.

28. There is a dot located within this grid. Write the location of this dot in this blank_______________________.



(Answer: 5C.)

29. On this grid system, start near the center and draw a line 3 units to the east, 2 units toward the north, 4 units to the west, 4 units to the south, 3 units toward the east, and 1 unit toward the south.



GRADE THREE ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

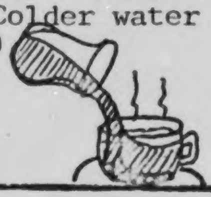
30. Provide 6-10 rocks. Say: Identify one observable characteristic that some of these rocks may have and separate them into groups according to that characteristic. (Choose from among the characteristics of size, shape, color, texture, etc.)

31. As an optional activity, gather shells from your environment to make a shell collection.

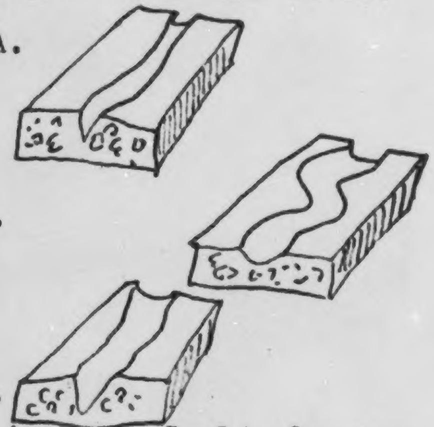
Behavioral Check List:

______Student continues to bring in shells.
______Student reads unassigned books and articles about shells.
______Student tries to interest others in shells by talking to them about his/her collection.
______Student expands his/her interest and collection to other fields of geology.

32. The drawing shows cold water to be poured into a cup of hot water. Where will the cold water be ten seconds after it is poured in? (Colder water sinks below warmer water.)



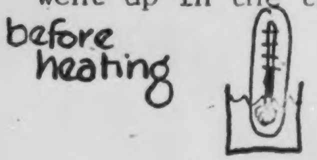
33. In the diagrams below, which is a young river, a mature river, and an old river? Label each river.

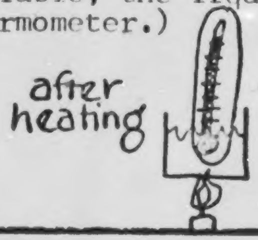


________A.
________B.
________C.

(Answers: A-young, B-old, C-mature.)

34. The two diagrams show a thermometer before and after heating. Why is the thermometer higher in the tube after heating? (Heating caused the liquid to expand and since no other expansion direction was available, the liquid went up in the thermometer.)





GRADE THREE ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

3:35-38

35. Weather observation for the day:

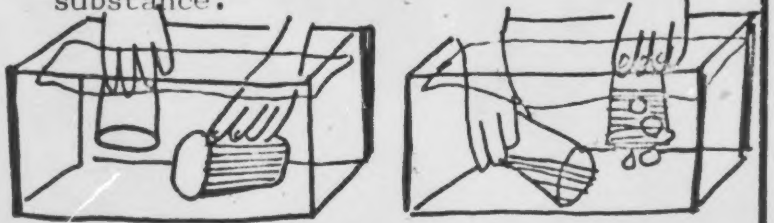
Sky Condition - Clear
Temperature - 40°
Wind Speed - 10 MPH

Circle the most likely estimate of the atmospheric pressure on this day:

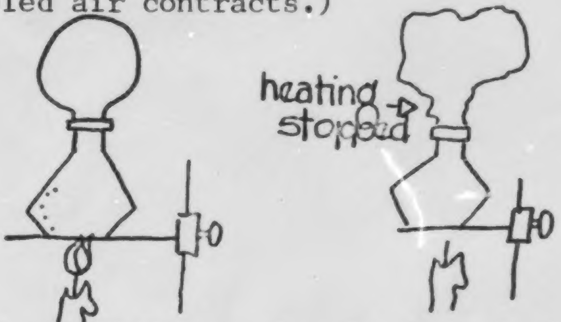
(1) low
(2) medium
(3) high
(4) cannot be determined from information given

(Answer: high.) (High pressure generally means good weather and low pressure bad weather.)

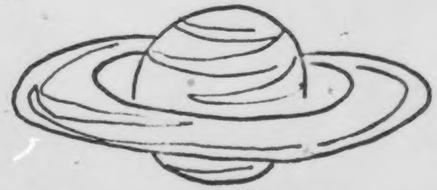
36. The following diagrams depict a sequence of events leading to the removal of water from jar (B). Is the substance that replaced the water in jar (B) a real substance? If so, identify the substance.



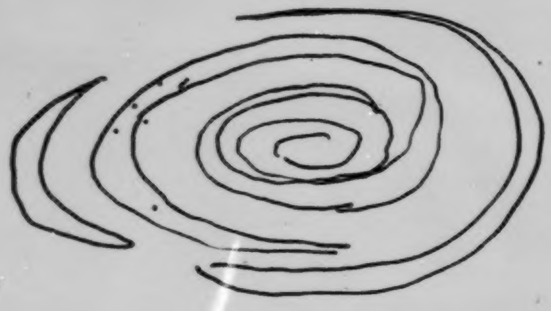
37. As shown in the diagrams, the balloon gets larger when the bottle is heated and gets smaller when the bottle is allowed to cool. Why does this happen? (Heated air expands and cooled air contracts.)



38. Look carefully at the drawing of the planet Saturn. State at least two observations about the planet. (Observations: There is more than one ring around the planet. The surface of the planet appears to be banded. Rings are disc shaped. The planet is round and flattened slightly at the poles.)



39. Look at the drawing below. What is it?
(a galaxy or a collection of stars)



4:1-8

GRADE FOUR OBJECTIVES
BIOLOGICAL SCIENCES

1. Variety & Pattern (Plants)-Observing

   The student will be able to identify the similarities in six different plants or plant pictures by indicating properties that the plants have in common. (lily, fern, moss, lichen, algae, grass, tomato, sultana, ivy, marigold, etc.) (similarities - roots present, leaves present, stem present, etc.)

2. Variety & Pattern (Plants)-Observing

   Given pictures of a plant at three one-week intervals, the student will be able to generate a comparison.

3. Variety & Pattern (Plants)-Classifying

   Given data from an investigation of mold growth on bread, the student will be able to identify each observation by marking whether it is a qualitative or a quantitative observation.

4. Variety & Pattern (Plants)-Inferring

   Given two plants, one grown in soil and one placed in soil, the student will be able to generate an inference to explain which would remain upright and why it would.

5. Variety & Pattern (Plants)-Classifying

   Given leaves of gymnosperms (evergreens) and angiosperms (flowering plants), the student will be able to classify the leaves into the two appropriate groups. (everygreens-pine, fir, cypress, etc.) (flowering plants-maple, oak, palm, birch, etc.)

6. Variety & Pattern (Plants)-Classifying

   Given a list of all the plant groups, the student will be able to classify the plants as spore or seed producers. (fern, oak tree, geranium, moss, bean, mushroom, mold, palm tree, seaweed, asparagus, etc.)

7. Variety & Pattern (Plants)-No Process

   The student will be able to recall the characteristics of a monocot as having one seed part and parallel leaves and of dicots as having two seed parts and branched, veined leaves.

8. Variety & Pattern (Animals)-Inferring

   The student will be able to generate an inference to explain the presence of insect skin in a container with insects of the same species. (two-week old container of nymph or larva stage insects - grasshoppers, etc.)

GRADE FOUR OBJECTIVES

BIOLOGICAL SCIENCES

4:9-12

9. Survival & Adaptation-Classifying

The student will be able to apply the concept that green plants are the basis for all food chains. (food chains: sunflower, aphid, lady bug, robin, cat; grass, cow, human; grain mouse, snake, hawk; cherry tree, web worm, sparrow, sparrow hawk; algae, protozoa, crabs, fish)

10. Interaction & Interdependence-Interpreting Data

Given a picture of a profile of a town and the location of fertilizer used, the student will be able to identify areas to which fertilizers move. (Fertilizers are water soluble and, therefore, move with water.

11. Interaction & Interdependence-Classifying

Given a definition of interdependence, the student will be able to identify sets of organisms showing this concept.

12. Continuity & Change-Measuring

Given a card, tape, and a hand lens (or microscope), the student will be able to estimate the number of airborne particulates and pollutants which become stuck to the tape.

GRADE FOUR OBJECTIVES
PHYSICAL SCIENCES

13. Matter-Observing

Given an opportunity to observe sugar and salt crystals, the student will be able to generate a description of the shape of each of the substances.

14. Matter-Observing

Given a demonstration of inflating three objects, the student will be able to identify two properties of a gas. (occupies space, takes the shape of the container)

15. Matter-Communicating

Given a table of data on two variables and told the variable to associate with each axis and asked to construct a bar graph of these data, the student will be able to label and provide increments correctly for the horizontal and vertical axes and transfer the data from the table to the graph.

16. Matter-Interpreting Data

Given a bar graph with labeled axes relating the weight of marbles to the number of marbles and asked to predict a relationship not shown on the graph, the student will be able to interpret the recorded data on the graph and report the prediction correctly.

17. Matter-Defining Operationally

Given a demonstration where equal amounts (e.g. 5-10 grams) of cornstarch and powdered sugar are mixed with equal amounts of iodine solution (e.g. 25 ml) in two labeled, clear containers and asked to use this demonstration to operationally define starch, the student will be able to state to the effect that a starch is a substance that forms a dark purple solution when added to an iodine solution.

18. Energy & Force-Classifying

Given a list of objects ranging from dark to light, the student will be able to select the best two light absorbers. (a navy blue suit, a tan suit, a black suit, a yellow suit, a white suit, etc.)

19. Energy & Force-Inferring

Given a demonstration of the effect of drop height on bounce height, the student will be able to generate an inference that the greater the release height the greater the bounce height.

GRADE FOUR OBJECTIVES
PHYSICAL SCIENCES

20. Energy & Force-Inferring

Given a diagram showing an inverted glass containing water covered with a piece of cardboard and showing no water spilling out, the student will be able to state that no water spills out because the upward push of air is holding the cardboard not allowing the water to spill out.

21. Energy & Force-Classifying

Given a list of several situations, the student will be able to identify the illustration of kinetic transfer of energy. (wind blowing a tree, rock on the ground, baby sleeping, etc.)

22. Matter-Energy Changes-Measuring

Given a thermometer and two liquids, the student will be able to measure and report the temperatures of both liquids.

23. Matter-Energy Changes-Inferring

Given information about measurements in the past, the student will be able to state that these measures were not consistent and accurate enough for today's purposes. (the joint of a man's thumb equalling one inch, etc.)

24. Matter-Energy Changes-Interpreting Data

Given a distance and a time an object traveled, the student will be able to compute the speed of the object.

25. Matter-Energy Changes-Measuring

The student will be able to select the metric unit appropriate to express measurements for each of several objects. (a person's height, a desk's height, the thickness of a pencil, etc.)

GRADE FOUR OBJECTIVES
EARTH-SPACE SCIENCES

4:26-32

26. Earth Classifying

Given a set of rocks, the student will be able to discriminate between the rocks according to several characteristics.

27. Earth-Formulating Hypotheses

When asked to predict what changes a New Ice Age might make in the earth's surface, the student will be able to generate a prediction that indicates that a New Ice Age would drastically alter the earth's surface.

28. Earth-Defining Operationally

The student will be able to demonstrate an application of the concept that a harder object will scratch a softer one when rubbed together. (Determine the relative hardness of two minerals.)

29. Earth-Experimenting

Given a jar of water, sand, and gravel, the student will be able to manipulate the equipment to show how sedimentary rocks form by shaking the jar and then stating that particles settle to the bottom of a body of water much the same way they settle to the bottom of the jar and eventually become compacted into a solid mass.

30. Water-Predicting

Given data on high and low tides, the student will be able to predict when the next high tide and low tide will occur.

31. Water-Inferring

Given cardboard models of circles of different sizes to represent Earth, Moon, and Sun, the student will be able to apply the concept that unusually high tides occur monthly when solar and lunar attractions add and that diminished tides occur monthly when they oppose.

32. Water-Identifying Variables

Given drawings of beaches, the student will be able to identify the variables which cause steepness of the beaches. (high wave action, strongly sloping beach; low wave action, gradual sloping beach)

GRADE FOUR OBJECTIVES
EARTH-SPACE SCIENCES

4:33-40

33. Water-Inferring

Given the information that daily tides result from a wave raised by the moon's gravitational pull which circles the Earth every twenty-five hours, the student will be able to apply the concept that the daily sequence of tidal rise and fall is made by the rotation of the Earth relative to the moon's gravitational attraction.

34. Water-Formulating Hypotheses

Given a description of movement of water particles in a wave, the student will be able to generate an hypothesis for the transfer of energy in an ocean wave from particle to particle and the hypothesis that the wave is in motion not the water.

35. Water-Using Space/Time Relationships

Given diagrams of a light source over cans of soil and water, the student will be able to state that the soil will heat faster than the water.

36. Water-Formulating Hypotheses

Given two samples of water, one with salt and one with no salt, the student will be able to predict that brine shrimp will hatch in the salt water.

37. Air-Interpreting Data

Given diagrams showing that air in an inverted jar displaces water, the student will be able to apply the concept that air takes up space.

38. Air-Interpreting Data

Given a weather chart indicating temperature, wind speed, and sky conditions for a two week period, the student will be able to identify those days which would not be best for an outdoor picnic and badminton game.

39. Air-Interpreting Data

Given diagrams showing two bags of air in balance in one case and out of balance after heating in the second, the student will be able to explain the concept that warm air is lighter than cold air.

40. Air-No Process

Given that the relative humidity is 100%, the student will be able to recall that the air is saturated or is holding all of the water vapor it can.

GRADE FOUR OBJECTIVES
EARTH-SPACE SCIENCES

41. Space-Observing

Given a chart of the circumpolar stars of the Northern hemisphere, the student will be able to identify Polaris (North Star).

42. Space-Classifying

Given two diagrams showing rotation and revolution, the student will be able to match each term to its illustration.

LEVEL: GRADE FOUR

CONTENT: Biological Sciences

Continuity & Change

PROCESS: Measuring

4:12

DETERMINING THE AMOUNT OF AIR POLLUTION*

OBJECTIVE #12

Given a card, tape, and a hand lens, the student will be able to estimate the number of airborne particulates and pollutants which become stuck to the tape.

ASSESSMENT #12

Punch a hole in each of the four 3 x 5 cards with the paper punch and place some cellophane tape over each hole. Fold the card in half with the sticky side inside so that it will not get dirty until you are ready to use it. Place the cards in various places such as a construction site with the sticky hole exposed. Collect the cards after several hours or on the next day and estimate the number of particulate and solid pollutants by using a hand lens. Record this.

RELATED ACTIVITY

The student will observe and describe particles on a microscope slide and determine the amount of air pollution in a given area.

Procedure:

1. Provide each student with a microscope slide coated on one side with a thin film of petroleum jelly.
2. Have students label the slides and decide where they should be placed and how long they should be exposed to the air.
3. At the end of the stated period of exposure to the air, have the students place slides on white sheets of paper.
4. Give each student a clean slide for comparison.
5. Provide magnifying glasses for observing the differences.
6. Descriptions should include location, time exposed, description of particle of air, and amount of pollution (number of particles).

MATERIALS

for each student:
- 2 microscope slides
- labeling tape and marker
- petroleum jelly
- 1 sheet of white paper
- paper and pencil for describing results

*Dade County Public Schools, Ecology in the Elementary School (Miami, Fla.: Dade County Public Schools Textbook Department, 1970), p. 156.

LEVEL: GRADE FOUR
CONTENT: Physical Sciences
Matter
PROCESS: Observing

4:13

DESCRIBING CRYSTALS

OBJECTIVE #13
Given an opportunity to observe sugar and salt crystals, the student will be able to generate a description of the shape of each of the substances.

ASSESSMENT #13

Using a magnifier, observe the two samples given to you and write a description of their shapes.

RELATED ACTIVITY

Procedure:

1. Place small amounts of salt, sugar, sand, and alum on microscope slides or under magnifiers.
2. Have students draw what they see.
3. Form crystals by heating one measured cup of water in a covered pan until it boils. Shut off the heat. Add 1-3/4 cups of granulated sugar to the hot water. Stir to dissolve all the sugar. Let the liquid cool. Pour the cool solution into a glass. Hang a weighted string from a pencil laid across the glass. As the water evaporates, the sugar comes out of the solution on the string and sides of the glass as crystals. After a week the crystals are large enough to be seen.
4. Form crystals by saturating hot water with table salt. Place a string around a pencil and place it in the salt solution. As the water evaporates, crystals form on the string.
5. Collect a sample of ocean water. Heat the water. Place a few drops on a slide and allow to evaporate. Observe the results under a microscope or magnifying glass.

MATERIALS

sugar
sand
alum
heating apparatus
container for boiling water
stirrer
2 glasses
2 strings
2 weights
2 pencils
water
salt
ocean water
microscope or hand lens

LEVEL: GRADE FOUR
CONTENT: Physical Sciences
Matter
PROCESS: Defining Operationally

4:17

IDENTIFYING THE PRESENCE OF STARCH

OBJECTIVE #17

Given a demonstration where equal amounts (e.g. 5-10 grams) of cornstarch and powdered sugar are mixed with equal amounts of iodine solution (e.g. 25 ml) in two labeled, clear containers and asked to use this demonstration to operationally define starch, the student will be able to state that a starch is a substance that forms a dark purple solution when added to an iodine solution.

ASSESSMENT #17

You have watched me work with two mixtures. The mixtures are labeled starch and iodine and powdered sugar and iodine. Use this demonstration to write an operational definition of starch.

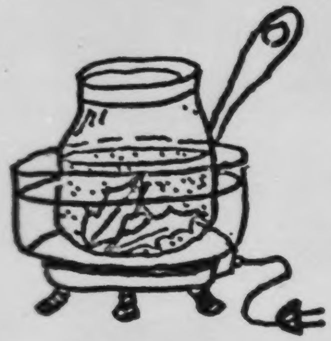
RELATED ACTIVITY

Procedure:

1. Obtain two leaves from a geranium or coleus plant which has been in the sunlight for at least three hours.
2. Place the leaves into a pint fruit jar and cover them with wood alcohol.
3. Stand the jar in a pan of water and place the pan on an electric burner.
4. Heat the water until the alcohol boils. (Caution: Don't breathe the fumes or let a flame come near the fumes.)
5. Remove the pan from the burner and let it cool.
6. Remove the leaves from the alcohol and rinse them in water.
7. The leaves should be white or light yellow, and the alcohol should be green.
8. Cover the leaves with diluted iodine to test for starch. (If the leaves were making starch from sugar, they will be blue.)

MATERIALS

- a geranium or coleus plant which has been in the sunlight for at least three hours
- wood alcohol
- an electric burner
- a pan of water
- a pint fruit jar
- iodine
- medicine dropper
- a metal tray
- a glass tray



LEVEL: GRADE FOUR

CONTENT: Physical Sciences

Energy and Force

PROCESS: Inferring

4:20

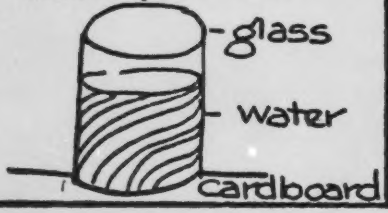
DESCRIBING THE EFFECT OF AIR PRESSURE

OBJECTIVE #20

Given a diagram showing an inverted glass containing water covered with a piece of cardboard and showing no water spilling out, the student will be able to state that no water spills out because the upward push of air is holding the cardboard not allowing the water to spill out.

ASSESSMENT #20

Look at this diagram which shows a glass of water turned upside down covered with a piece of cardboard. Why won't any water spill out?



RELATED ACTIVITY

Procedure:

1. Punch a small hole near the bottom of a can.
2. Put finger over the hole and fill the can with water.
3. With the top off the can, remove the finger from the hole and watch water flow from it in a steady stream. (See sketch.)
4. Refill can and fasten the top to it securely. A finger must be on the hole while refilling.
5. Remove the finger from the hole and observe the results.

Teacher Information:

When the container has no top on, the weight of the water forces it out of the small hole in a steady stream. When the cover is on, the air pressure cannot exert force downwards on the water in the can. At the same time, air pressure acting against the water in the hole does not permit any to escape.

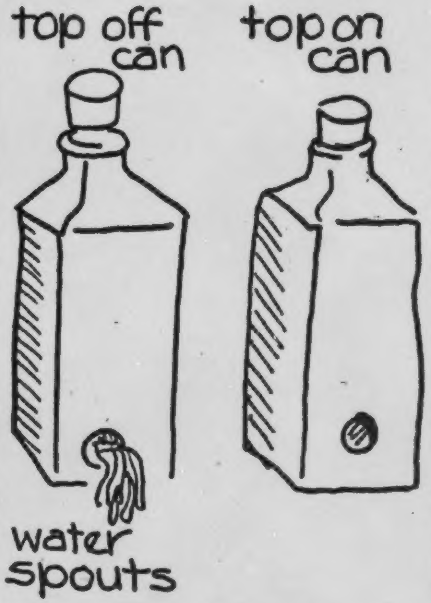
6. Punch many small holes lined up vertically and compare results.

MATERIALS

small metal or plastic can with removable top

instrument for punching holes in the can

water



LEVEL: GRADE FOUR

CONTENT: Earth-Space Sciences
Water

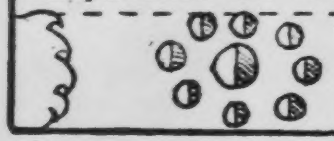
PROCESS: Inferring

4:31

DESCRIBING THE PHASES OF THE MOON

OBJECTIVE #31
Given cardboard models of circles of different sizes to represent Earth, Moon, and Sun, the student will be able to apply the concept that unusually high tides occur monthly when solar and lunar attractions add and that diminished tides occur monthly when they oppose.

ASSESSMENT #31
Arrange the three objects you were given in two ways to explain monthly higher tides and lower tides. Use one object to represent the Sun, a smaller object to represent the Earth, and the smallest object to represent the Moon.



RELATED ACTIVITY

Procedure:

1. Provide students with general information about the Earth and the Moon including the following facts. The rotation of the Earth causes day and night. The Moon is about one-third the size of the Earth. The Moon is a satellite revolving around the Earth. The Moon's diameter is about 2,160 miles. The Moon is approximately 240,000 miles from the Earth. The Earth's daily tides are caused by a wave raised by the Moon's gravitational pull which circles the Earth every twenty-five hours.
2. Use a flannel board to show the phases of the Moon. Place the Sun and its rays at the left side of the board. Place the Earth to the right of the center of the board, the darker side away from the Sun.
3. Place the Moons on the board as follows: new moon passing between Sun and Earth, second phase or crescent-shaped moon, first quarter appearing about one week after new moon, fourth phase or waxing moon, full moon appearing at end of second week and on side of Earth away from the Sun, sixth or waning moon, third quarter appearing third week of the cycle, and last phase or crescent-shaped moon.
3. Discuss the effect on tides of the alignment of Sun, Moon, and Earth.

MATERIALS

flannel board (blue preferred, 18 x 24)
colored construction paper:
- portion of Sun & rays
- Earth, green (half dark, half light)
- 8 moons (each half dark, half light)

LEVEL: GRADE FOUR

CONTENT: Earth-Space Sciences

Air

PROCESS: Interpreting Data

4:38

INTERPRETING CLOUD FORMATIONS

OBJECTIVE #38

Given a weather chart indicating temperature, wind speed, and sky conditions for a two week period, the student will be able to identify those days which would not be best for an outdoor picnic and badminton game.

ASSESSMENT #38

For the days indicated below giving daily temperature, wind speed, and sky condition observations, place an X beside the days which would not be good for an outdoor picnic and a badminton game.

Days	Temp.	Wind	Sky
Sun.	95	calm	clear
Mon.	86	breeze	partly cloudy
Tues.	93	calm	partly cloudy
Wed.	70	windy	cloudy

RELATED ACTIVITY

Students will become familiar with the various types of cloud formations by associating charted pictures with actual formations.

Procedure:

1. Mount pictures of clouds on tagboard.
2. Identify and label each picture.
3. Explain the common cloud formations and describe the type of weather that is commonly found when they appear.

   Cumulus-Generally are signs of good weather, unless they continue into the night. If so, rain is probable.

   Cirrus-Usually precede low pressure areas. These are often the first warnings of an approaching hurricane. They may be associated with fair weather. If they move fast and change into sheets, they forecast bad weather. If they dissipate, fair weather will follow.

   Stratus-Associated most often with outside edges of cyclone and, therefore, good weather usually follows.
4. Determine if clouds you see in the sky help to predict what the weather will be for the next day by recording observations, predictions, and actual weather occurrences over a two week period.
5. Compare the predictions to the actual data. Generalize the reliability of weather predictions that are based on cloud formations.

MATERIALS

pictures of clouds

tagboard

paste, scissors

marker

LEVEL: GRADE FOUR

CONTENT: Earth-Space Sciences

Air

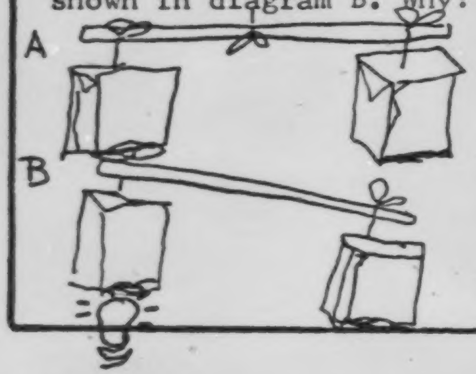
PROCESS: Interpreting Data

4:39

HEATING AIR

OBJECTIVE #39
Given diagrams showing two bags of air in balance in one case and out of balance after heating in the second, the student will be able to explain the concept that warm air is lighter than cold air.

ASSESSMENT #39
Examine diagrams A and B. In A the system is balanced. After one bag is heated, the system no longer is in balance as shown in diagram B. Why?



RELATED ACTIVITY
Teacher Information:
Heat causes air to expand. As air expands it becomes lighter. Cold causes air to contract. As air contracts it becomes heavier. Air has weight. Air has pressure because it has weight and movement.

Procedure:
1. Make a loop out of a foot long piece of thread and use it to support a yardstick at the halfway mark.
2. Tie the other end of the thread in a loop and attach over a pencil, supported under several books set near the end of a table.
3. Make two pin-size holes in the bottom of each of two paper bags, run a piece of thread through the holes, and make the thread into a loop.
4. Hang both bags on the yardstick as shown in the sketch. If the bags are exactly the same weight they should make the stick balance when they are placed one inch from each end. You may have to adjust one bag slightly until they are balanced.
5. Hold an electric light bulb below the mouth of the open bag until the air inside is warmed. (Safety precautions are required.)
6. Remove the bulb.
7. Observe the results.

Questions:
1. Does the shape of hot air balloons have anything to do with their ability to fly?
2. What does the change in the temperature of the air have to do with wind?

MATERIALS
thread, yardstick, pencil, 2 paper bags, lamp without shade, books

214

LEVEL: GRADE FOUR

CONTENT: Earth-Space Sciences

Air

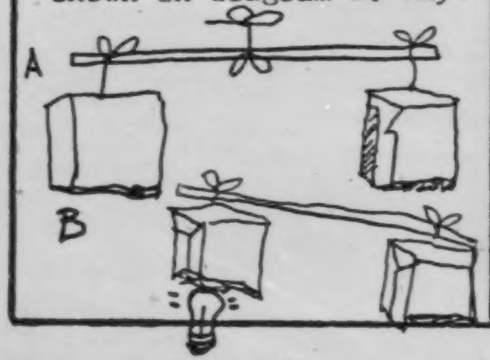
PROCESS: Interpreting Data

4:39

PROVING THAT AIR HAS WEIGHT

OBJECTIVE #39
Given diagrams showing two bags of air in balance in one case and out of balance after heating in the second, the student will be able to explain the concept that warm air is lighter than cold air.

ASSESSMENT #39
Examine diagrams A and B. In A the system is balanced. After one bag is heated, the system no longer is in balance as shown in diagram B. Why?



RELATED ACTIVITY

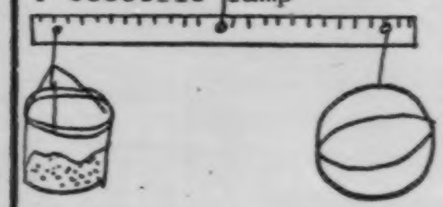
Teacher Information:
Releasing air from an inflatable object makes it lighter, therefore indicating that air has weight.

Procedure:
1. Suspend a yardstick from a string through the middle hole of the stick.
2. Suspend a blown up basketball from one end hole.
3. Suspend a coffee can from a hole at the other end.
4. Fill the can with sand until it balances.
5. Release all of the air from the ball.

Questions:
1. Does this prove that air has weightt? How?
2. If the basketball is filled with air again, will the apparatus balance again?

MATERIALS

yardstick with holes drilled at 6 inch, 18 inch, and 30 inch marks
basketball filled with air
coffee can
sand
cord, string, or wire
2 paper bags
1 electric lamp



GRADE FOUR RELATED MATERIALS 4:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
1. Identifying similarities in plants.		5:76-83		4:354-381 4:412-420 5:21-56		
2. Comparing a plant at various stages of growth.			Pt. 3: 157-161 Pt. 4: 121-129			
3. Classifying mold observations as qualitative or quantitative.						
4. Explaining why a plant grown in soil remains upright.						
5. Classifying leaves of angiosperms and gymnosperms.		5:77				
6. Classifying plants as spore or seed producers.		5:76-83				
7. Recalling the characteristics of monocots and dicots.						

GRADE FOUR RELATED MATERIALS

4:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
8. Explaining the presence of insect skin.						
9. Classifying green plants as the basis for all food chains.		3:187-193 5:289-299				
10. Identifying areas to which fertilizers move.		4:21-22				
11. Identifying sets of organisms showing interdependence.		3:182-210 5:280-313		6:89-102		
12. Measuring the number of airborne particulates and pollutants.	DETERMINING THE AMOUNT OF AIR POLLUTION		Pt. 3: 49-55			
13. Describing the shape of crystals.	DESCRIBING CRYSTALS					
14. Identifying two properties of a gas.		3:122-123 4:169	Pt. 6: 233-246 255-260 Pt. 7: 107-118			

GRADE FOUR RELATED MATERIALS

4:15-21

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
15. Constructing a bar graph from given data.			Pt. 3: 57-63 101-103 Pt. 4: 57-66	4:86-115 4:382-411		
16. Predicting further data from a bar graph of marble weight & no.						
17. Stating the operational definition of a starch.	IDENTIFYING THE PRESENCE OF STARCH	4:44-48	Pt. 5: 97-104	3:270-302 4:225-264		
18. Identifying the best light absorbers.		3:82-83				
19. Inferring the relationship between bounce and release height.		5:223	Pt. 4: 1-7 159-163			
20. Inferring the effect of air pressure.	DESCRIBING THE EFFECT OF AIR PRESSURE	3:124-133				
21. Identifying kinetic transfer of energy.		3:38		4:95-115 5:244-258 6:399-407		

GRADE FOUR RELATED MATERIALS 4:22-28

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
22. Measuring the temperature of liquids.		3:156-167 5:118		4:86-115 4:282-295		
23. Describing measurements in the past.		3:24-26 3:146-147				
24. Computing the speed of an object.						
25. Selecting the appropriate metric unit for measuring.		3:10-37	Pt. 3: 163-166 181-185 Pt. 5: 57-68			
26. Classifying rocks according to characteristics.			Pt. 5: 113-118			
27. Predicting the effect of a New Ice Age.						
28. Determining the relative hardness of two minerals.		5:225	Pt. 5: 113-118			

GRADE FOUR RELATED MATERIALS 4:29-35						
OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
29. Demonstrating how sedimentary rocks form.		5:142-179				
30. Predicting when the next low and the next high tide will occur.		3:118-119				
31. Demonstrating why unusually high and diminished tides occur monthly.	DESCRIBING THE PHASES OF THE MOON	3:112-117				
32. Identifying the variables which cause steepness of beaches.						
33. Describing the reason for the daily sequence of tides.						
34. Describing the transfer of energy in an ocean wave.						
35. Stating that soil heats faster than water.		3:188 3:194				

GRADE FOUR RELATED MATERIALS 4:36-42

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
36. Predicting that brine shrimp will hatch in salt water.			Pt. 4: 81-85 Pt. 6: 221-232			
37. Applying the concept that air takes up space.		3:122				
38. Interpreting a weather chart.	INTERPRETING CLOUD FORMATIONS					
39. Explaining that warm air is lighter than cold air.	PROVING THAT AIR HAS WEIGHT	3:134-143 5:120-131				
	HEATING AIR					
40. Defining relative humidity.						
41. Identifying Polaris.		4:198-201	Pt. 6: 1-21			
42. Classifying diagrams as depicting rotation or revolution.		3:96-119 5:263-266				

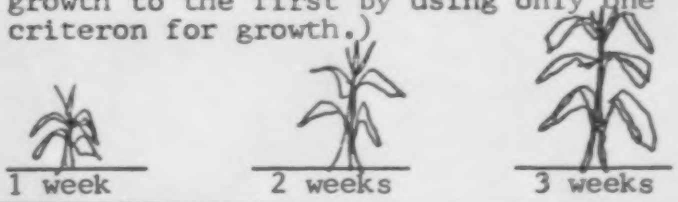
GRADE FOUR ASSESSMENT ITEMS 4:1-4

BIOLOGICAL SCIENCES

1. Provide six plants (e.g., lily, fern, moss, lichen, algae, grass, tomato, sultana, ivy, marigold, etc.). Say: Using the checklist and the six plants on the table, determine for each plant if it has roots, stems, and leaves and plot your findings on the checklist.

PLANT NAME	ROOTS PRESENT	LEAVES PRESENT	STEM PRESENT
Moss			
Algae			
Lichen			
Ferns			
Grass			
Ivy			

2. Here are three drawings of the same plant at one-week intervals. Compare the growth using the first week's plant as your basis. (The description must compare the second and third weeks' growth to the first by using only one criteron for growth.)



3. These data were observed and taken during an experiment relating to mold growth. Circle the data which are quantitative and underline the data which are qualitative.

Day #1. Black dots appeared on the bread; most of the dots were under 1 mm. No change in odor noticed.

Day #2. There now appears blue-green areas on some of the bread. A noticeable odor is present. Mold covers 2.5 x 3.5 cm area.

Day #3. The area of the bread covered by mold is now 5 cm x 7 cm. The entire surface is black with green streaks. Small stalks came out of the green areas. They are 2 mm high in some places. Dust comes out of the mass when it is disturbed. It has an unpleasant odor.

(Answers: Day #1 - both; Day #2 - both;
Day #3 - both.)

4. If a strong wind from a fan was designed to blow across two plants of equal size, which of these two would remain upright and why? One plant has been grown from a seed in the same pot, shaken to remove the soil, and placed back in the soil. The other plant was grown in the pot from seed.

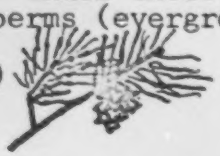
GRADE FOUR ASSESSMENT ITEMS

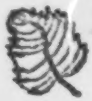
BIOLOGICAL SCIENCES

4:5-8

5. Write an "A" under those leaves that represent angiosperms (flowering plants) and "G" under those that represent gymnosperms (evergreens).

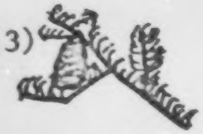
____(1)

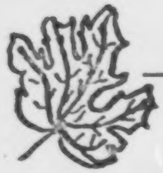




____(2)

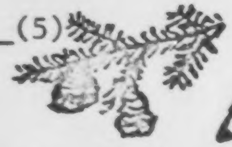
____(3)

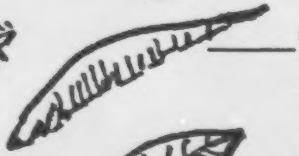




____(4)

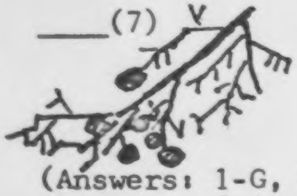
____(5)

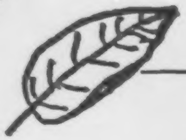




____(6)

____(7)





____(8)

(Answers: 1-G, 2-A, 3-G, 4-A, 5-G, 6-A, 7-A, 8-A)

6. Underline the spore producers and circle the seed producers in this list of plants.

(1) mushroom
(2) grass
(3) moss
(4) bean
(5) pine tree
(6) fern
(7) algae
(8) geranium
(9) bread mold
(10) pea

(Answers: Spores - 1, 3, 6, 7, 9; Seeds - 2, 4, 5, 8, 10.)

7. Match the plant seed type to its characteristics by drawing a line from each type to its characteristics.

A. Monocot
B. Dicot

1. one seed part
2. two seed parts
3. parallel veined leaves
4. branched veined leaves

(Answers: A - 1, 3; B - 2, 4.)

8. Provide a container of caterpillars which have molted and where the molted skins are present. Say: In this container there are some caterpillars and skins of caterpillars. Make an inference as to where the skins came from and how they got into the container. (Utilize a two-week old container of grasshoppers, crickets, etc. in the nymph or larva stage.)

GRADE FOUR ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

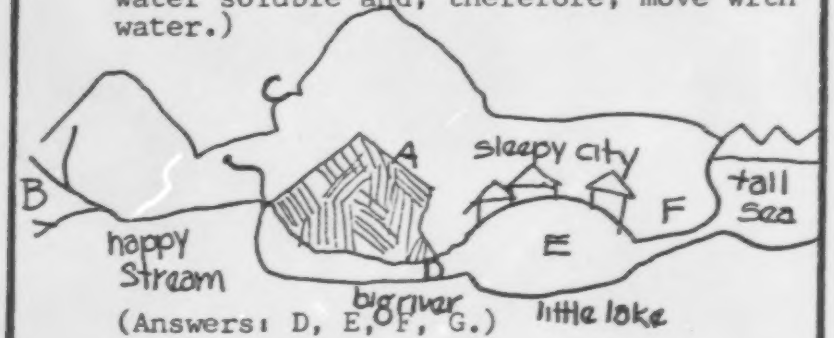
4:9-12

9. These are five food chains. What characteristic do you see that all food chains have in common?

   (1) sunflower, aphid, lady bug, robin, cat
   (2) grass, cow, human
   (3) grain, mouse, snake, hawk
   (4) cherry tree, web worm, sparrow, sparrow hawk
   (5) algae, protozoa, crabs, fish

   (Answers: green plant or the first word of each given chain.)

10. Look at this drawing of a valley. At the fields (A) fertilizer is used. This is the only place it is used. List the letters of other locations you would find fertilizers. (Fertilizers are water soluble and, therefore, move with water.)



   (Answers: D, E, F, G.)

11. Interdependence is defined as the dependence of one or more organisms on each other in an environment. Check the sets of animals in this list which exhibit interdependence.

   (1) the cow and horse
   (2) grain, such as wheat, and man
   (3) the termite and intestinal protozoa
   (4) fleas and dogs
   (5) fish and crabs

   (Answers: 2, 3, 4.)

12. Punch a hole in each of four 3 x 5' cards and place some cellophane tape over each hole. Fold the cards in half with the sticky side inside so that it will not get dirty until you are ready to use it. In this way your card will not collect pollutants which are not a part of your investigation. Place the cards in various places such as a construction site or a school room, with the sticky hole exposed. Collect the cards after several hours or on the next day and estimate the number of particulate and solid pollutants by using a hand lens. Record your estimations.

GRADE FOUR ASSESSMENT ITEMS

PHYSICAL SCIENCES

4:13-16

13. Provide samples of chemically pure crystalline sodium chloride and sugar. Say: Using a magnifier, observe the two samples and write a description of their shapes.

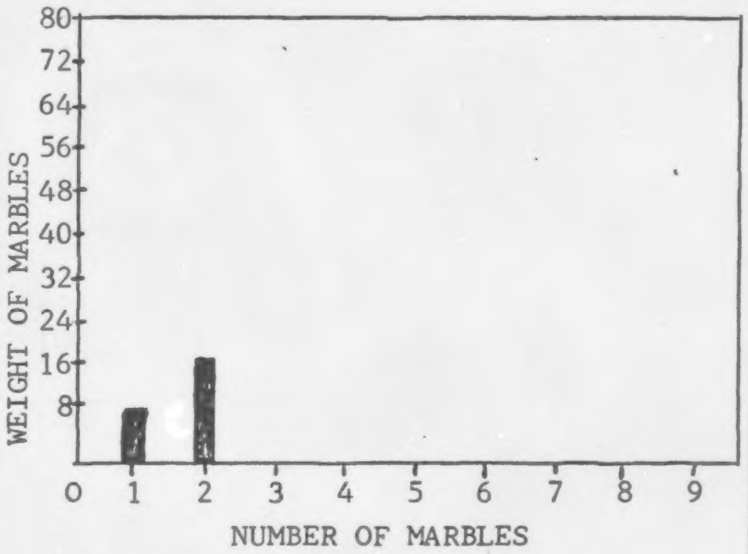
14. Provide a demonstration of inflating a balloon, a plastic toy float, and a paper sack. Say: You have watched me blow a gas into each of these objects. Name two properties of a gas which you have seen. (Answers: Gases occupy space and take the shape of the container that they are in.)

15. Prove a table of data, graph paper, and a pencil. Here is a table of data:

Number of atoms in each molecule	Number of Molecules
1	7
2	8
3	6
4	3
5	3
6	2
7	1
8	2

With this graph paper, construct a bar graph of these data, putting the number of molecules on the vertical axis and the number of atoms in each molecule along the horizontal axis.

16. Here is a graph that shows the weight of some marbles. How many marbles make a weight of 32?



(Answer: 4 marbles.)

GRADE FOUR ASSESSMENT ITEMS

PHYSICAL SCIENCES

4:17-22

17. Provide a demonstration where equal amounts (e.g. 5-10 grams) of cornstarch and powdered sugar are mixed with equal amounts of iodine solution (e.g. 25 ml) in 2 labeled clear containers. Say: You have watched me work with two mixtures. The mixtures are labeled starch and iodine and powdered sugar and iodine. Use this demonstration to write an operational definition of starch. (Starch is a substance that forms a dark purple solution when added to an iodine solution.)

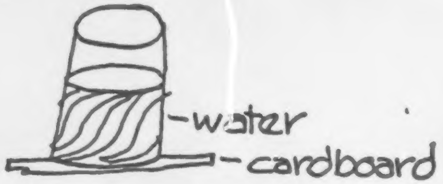
18. Check the two cotton suits that are the best absorbers of light rays.

_____a navy blue suit
_____a tan suit
_____a black suit
_____a yellow suit
_____a white suit

(Answers: navy blue and black suits.)

19. Provide 3 demonstrations showing the effect of drop-height on the bounce height of a tennis ball. Say: You have watched me drop this ball from three different heights. Explain how the height of the ball affects the bounce of the ball. (The greater the released height of the ball the faster it will travel and the higher it will bounce.)

20. Look at this diagram which shows a glass of water turned upside down covered with a piece of cardboard. In your own words, tell why the water won't spill out. (Since air exerts pressure in all directions, the upward push of air is holding the cardboard and not allowing the water to spill out.)



21. One or more of the statements below shows kinetic energy being transferred. Place an X next to each statement that shows this.

___(1) wind blowing a tree
___(2) a rock on the ground
___(3) a baby sleeping

(Answer: #1.)

22. Provide two containers of liquids at different temperatures and a thermometer. Say: Measure and report the temperatures of the two liquids.

GRADE FOUR ASSESSMENT ITEMS
PHYSICAL SCIENCES

23. Long ago people used everyday objects to measure things. For example, the length of the joint in a man's thumb was equal to one inch or the length from a man's nose to the end of his fingers was equal to one yard. Why are these units of measure not useful today? (To be accurate, standard units of measurement are necessary and previous measures were not consistent.)

24. Imagine an object traveling for 7 hours and covering a distance of 210 miles. What is the speed of the object?

(Answer: 30 miles per hour.)

25. Imagine the objects below and decide the best metric unit to express the measurement of each object.

(1) the height of a person____________
(2) the height of your desk____________
(3) the length of a book page__________
(4) the length of a classroom floor____
(5) the thickness of a pencil__________

(Answers: 1-meters, 2-centimeters, 3-centimeters, 4-meters, 5-millimeters.)

GRADE FOUR ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

4:26-31

26. Provide a variety of 12 rocks. Say: Separate the rocks into various groupings according to common characteristics each grouping may have. (Any characteristics such as size, color, texture, etc. may be used.)

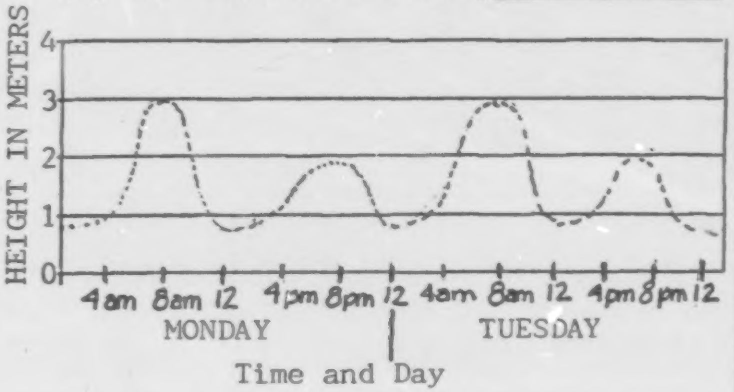
27. What changes might a New Ice Age make in the earth's surface? (A New Ice Age would alter the earth's surface by forming new lakes, rivers, and mountains. The level of the oceans would drop as a result of large amounts of the earth's waters being frozen into glaciers.)

28. If you had two minerals to compare, how could you determine their relative hardness? (A softer object will be scratched by a harder one when rubbed together.)

29. Provide an empty quart jar, a handful of sand, a handful of gravel, and a container of water. Say: Using these materials, show and explain how sedimentary rock may form. (Particles settle to the bottom of a body of water much the same way they settle to the bottom of the jar and eventually become compacted into a solid mass.)

30. The graph depicts high and low tides for two days. At what times will the following occur on Wednesday?

(1) high tide on Wednesday__________
(2) low tide on Wednesday__________



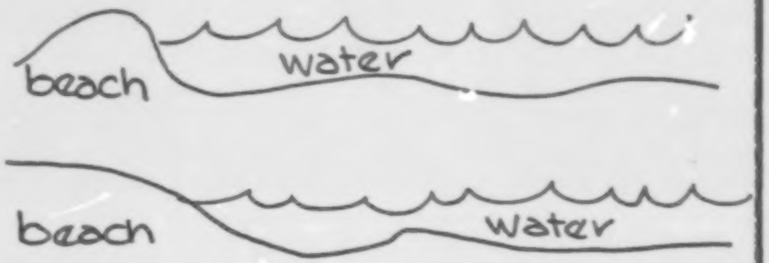
(Answer: High - approximately 8:00 am;
Low - approximately 12:30 am.)

31. Provide cardboard circles of 3 different sizes. Say: You have been given three circles. Let one represent the Sun, a smaller one represent the Earth and the smallest represent the moon. Arrange the three to explain monthly higher tides and monthly lower tides. Two arrangements will be necessary. (Sun and moon will be aligned for higher tides and in opposition for diminished tides.)

GRADE FOUR ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

4:32-35

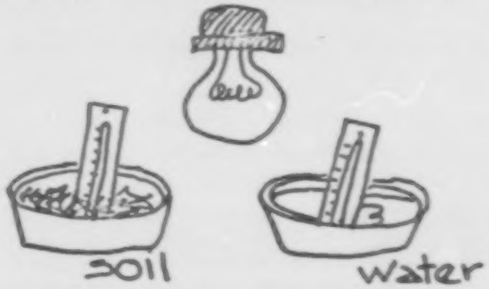
32. These are drawings of two beach profiles. Give one variable which probably caused the difference in the profiles. (high wave action - strongly sloping beach; low wave action - gradual sloping beach) (Answer: wave action.)



33. The gravitational pull of the moon on the Earth causes a wave which circles the Earth every twenty-five hours. Explain why this length of time is approximately twenty-five hours. (The rise & fall of tides in most places in the ocean is generated by the rotation of the Earth relative to the gravitational pull of the moon.

34. Provide a description of a ball forming a vertical circle as a wave moves out from a beach. Say: A ball forms a vertical circle as an ocean wave moves out from a beach. How does this compare to the movement of a water particle? Why does it move this way? (A wave is the manifestation of an energy transfer from particle to parparticle such that the wave moves but the water particles rotate in a localized area. The wave is in motion not the water.)

35. In the following diagram, which will heat faster? Why? (Water has a higher heat holding capacity than the soil and is slower to heat. Soil will heat faster than the water.)



GRADE FOUR ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

4:36-38

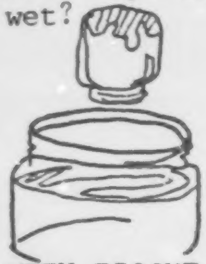
36. Put an X in the box matching the water sample you predict that brine shrimp will hatch in.

(1) _____salty

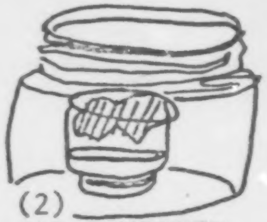
(2) _____tap water

(Answer: Brine shrimp eggs will hatch in the salt water.)

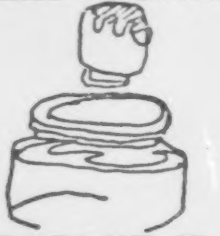
37. The diagrams illustrate a sequence of events. Why doesn't the tissue paper get wet?



(1)
JAR WITH TISSUE PAPER
ATTACHED TO BOTTOM



(2)
JAR INSERTED
IN WATER



(3)
JAR TAKEN OUT OF WATER
AND TISSUE IS NOT WET

(Answer: Air takes up space.)

38. On your two week weather chart, place an X beside the days which would not be good for an outdoor picnic and a badminton game.

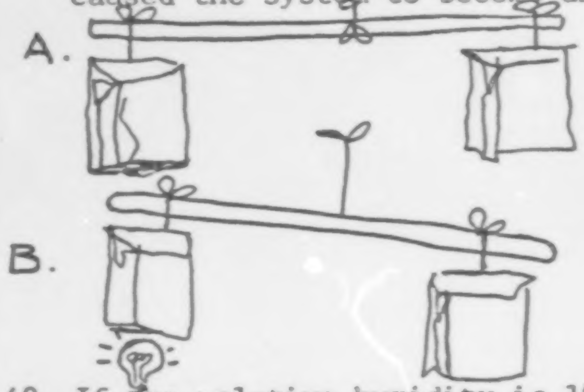
DAYS OF WEEK	TEMPERATURE	WIND SPEED	SKY CONDITIONS	
Sunday	95°	Calm	Clear	
Monday	86°	Breeze	Partly Cloudy	
Tuesday	93°	Calm	Partly Cloudy	
Wednesday	80°	Strong Wind	Clear	X
Thursday	70°	Strong Wind	Partly Cloudy	X
Friday	74°	Calm	Clear	
Saturday	50°	Calm	Cloudy	X
Sunday	76°	Strong Wind	Partly Cloudy	X
Monday	80°	Breeze	Clear	
Tuesday	78°	Strong Wind	Cloudy	X
Wednesday	85°	Calm	Clear	
Thursday	92°	Breeze	Clear	
Friday	84°	Strong Wind	Partly Cloudy	X
Saturday	90°	Strong Wind	Clear	X

GRADE FOUR ASSESSMENT ITEMS

4:39-42

EARTH-SPACE SCIENCES

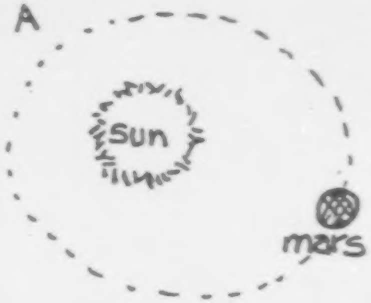
39. Examine diagrams A and B. In A the system is balanced. After one bag is heated, the system no longer is in balance as shown in diagram B. Why? (Answer: Warm air weighs less than cold air. The heated bag became lighter and caused the system to become unbalanced.)

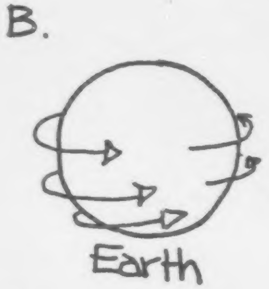


40. If the relative humidity is 100%, what can you say about the amount of water that the air is holding compared to the amount of water that the air can potentially hold? (Relative humidity means that the air is saturated or is holding all of the water vapor it can.)

41. On the star chart locate and place an X on the star Polaris (North Star). (Utilize a chart of the circumpolar stars of the Northern hemisphere.)

42. Examine both illustrations. Write the word rotation under the drawing that shows rotation and the word revolution under the drawing that shows revolution. (Rotation is the motion of the planet on its axis. Revolution is the motion of the planet around the sun.)





GRADE FIVE OBJECTIVES
BIOLOGICAL SCIENCES

5:1-7

1. Variety & Pattern (Plants)-Experimenting

   The student will be able to originate a design of an experiment to demonstrate how light affects the growth of plants.

2. Variety & Pattern (Plants)-Inferring

   Given pictures of fossil plants, the student will be able to construct an inference as to how the plants became fossilized. (Student must include that the plant was deposited in a material which later became rock.)

3. Variety & Pattern (Plants)-Classifying

   The student will be able to identify the drawings of algae. moss, fern, fungi, grass, and a seed plant.

4. Variety & Pattern (Plants)-Formulating Hypotheses

   Given a graph representing the loss of moisture from sections of fresh fruits or vegetables over periods of time, the student will be able to generate a prediction and state a generalization that indicates that the longer the period of exposure, the greater the loss of moisture.

5. Variety & Pattern (Animals)-Interpreting Data

   Given data about nicotine from a cigarette, the student will be able to apply the conventions of graphing to construct a graph showing what happens to the nicotine by percentage. (The bar or line graph must include a title, a scale on each axis, the axes being labeled, the scales being on the lines and not in the spaces, and the points or bars being in the correct positions.)

6. Variety & Pattern (Animals)-Classifying

   Given bird wings or drawings or pictures of bird wings and asked to identify the kinds of motion for which each wing is designed, the student will be able to classify each wing according to its physical characteristics. (Sample must include wings for soaring, speed, gliding and diving, long flights, and swimming.)

7. Variety & Patter (Animals)-Formulating Hypotheses

   The student will be able to originate a description of hibernation in amphibians. (burrowing in the mud and reducing metabolism, growth, etc.)

GRADE FIVE OBJECTIVES
BIOLOGICAL SCIENCES

8. Variety & Pattern (Animals)-Experimenting

Given the hypothesis that insects with long bodies can run faster than insects with shorter bodies, the student will be able to originate an experiment to test the hypothesis.

9. Variety & Pattern (Animals)-Classifying

Given drawings or pictures of bird feet and asked to identify their function, the student will be able to classify each foot into its major function based on the foot's physical characteristics. (climbing, scratching, running, grasping, swimming)

10. Variety & Pattern (Animals)-Classifying

Given drawings or pictures of bird heads and asked to identify the beaks which could be used to tear food, crush hard food, spear fish, eat bugs, and peck grain, the student will be able to classify each type of beak by its shape or size.

11. Variety & Pattern (Microbes)-Classifying

The student will be able to identify how such microbes move from place to place as bacteria, virus, mold, etc. (riding air currents, on/in animals, etc.)

12. Variety & Pattern (Microbes)-Inferring

Given several examples of killing micro-organisms, the student will be able to state that the reason for each action is to kill micro-organisms that may be harmful to man. (a hiker boils water from a stream before drinking, a person puts iodine on an open cut, etc.)

13. Variety & Pattern (Microbes Interpreting Data

Given a pictorial representation of how bacteria found in a human's mouth responds to various mouth washes, the student will be able to generate a verbal interpretation of this data. (Use petri dish inoculated with mouth bacteria and incubated at 40 degrees C. for twenty-four hours for basis of applying mouth wash on a sterile gauze pad.)

14. Survival & Adaptation-Identifying Variables

Given environmental conditions for seed growth, the student will be able to predict success of growth. (Consider various combinations of good soil, good light, soaked continually, watered once, vinegar daily, etc.)

GRADE FIVE OBJECTIVES
BIOLOGICAL SCIENCES

5:15-17

15. Interaction & Interdependence-Identifying Variables

    The student will be able to identify the variables that determine the size of a given predator-prey population. (Include the variables of food and predators or other controls imposed on the population size.)

16. Continuity & Change-Measuring

    Given a jug, a basin, a rubber tube, water, blocks, and a ruler, the student will be able to compare lung capacity before and after active exercise.

17. Continuity & Change-Communicating

    Given a list of endangered animal species and a statement that they are being killed never to be seen again by man, the student will choose to speak in favor of protecting the animals.

GRADE FIVE OBJECTIVES

PHYSICAL SCIENCES

5:18-24

18. Matter-Formulating Hypotheses

Given a description of what happens to steel wool left in an inverted tube of water, the student will be able to state a hypothesis to account for observed changes. (As the steel wool rusts, the water level rises in the tube. Rusting takes up oxygen. As the oxygen from the air combines with the steel wool (iron), the oxygen is replaced by water.)

19. Matter-Classifying

Given a list of elements and compounds, the student will list each separately. (water, oxygen, silver, baking soda, vinegar, nitrogen, copper, etc.)

20. Matter-Inferring

Given information that a magnet separates the iron from an unheated mixture of iron and sulfur but will not in a heated mixture, the student will be able to state that the heat has caused the iron and sulfur to change from a mixture to a compound with different properties, one of them being that it is no longer magnetic.

21. Matter-Classifying

Given a list of statements concerning states of matter and changes of matter, the student will be able to identify which statements are correct by labeling them.

22. Matter-Classifying

Given a list of statements about atoms, molecules, elements, compounds, mixtures, and solutions, the student will be able to identify the correct statements.

23. Matter-Formulating Hypotheses

Given a data chart depicting the relationship between dissolving time and the temperature of the solvent, the student will be able to state a hypothesis to the effect that as the temperature of the solvent increases, the dissolving time will decrease.

24. Matter-Energy Changes-Inferring

Given a demonstration of ink added to water, the student will be able to state that the spread of the ink is caused by the continuous random motion of molecules.

GRADE FIVE OBJECTIVES
PHYSICAL SCIENCES

5:25-29

25. Matter-Defining Operationally

Given a demonstration where equal amounts (e.g., 5-10 grams) of baking soda and talc are mixed with equal amounts of water (e.g., 50 ml) in two labeled, clear containers and after allowing time to observe both mixtures are passed through a piece of filter paper and told that the mixture containing the baking soda and water is a solution and asked to use the demonstration to write an operational definition of a solution, the student will be able to state to the effect that a solution is a mixture in which the solid particles are no longer visible and cannot be separated from the water by filter paper.

26. Matter-Classifying

Given at least three samples of granular substances (e.g., salt, alum, Epsom salt) and a magnifying glass, the student will be able to classify the samples according to their geometrical shapes. (salt and alum-isometric; Epsom salt-hexagonal)

27. Matter-Energy Changes-Using Space/Time Relationships

Given materials (e.g., a marble, an elevated track at least six feet long and marked in units, and a clock that can measure in second), the student will be able to determine the speed of an object as it moves over a distance.

28. Energy & Force-Predicting

Given a diagram of a lever system and materials to construct a system like the one in the diagram, the student will be able to manipulate the materials and the fulcrum to determine whether the load is easier to move with the fulcrum located near the load or with the fulcrum located near the effort force.

29. Energy & Force-No Process

Given a description of a situation where friction is evidenced by heat production, the student will be able to classify the force as frictional.

GRADE FIVE OBJECTIVES

5:30-38

EARTH-SPACE SCIENCES

30. Earth-Communicating

Given a list of sources of natural energy, the student will be able to select any two and suggest unique ways that they might be utilized by man.

31. Earth-Inferring

The student will be able to generate a concept concerning how solids build up on the bottoms of lakes, oceans, and rivers.

32. Earth-Interpreting Data

Given an outline map of South America and Africa, the student will be able to demonstrate an application of the concept that the two continents were once a single continent.

33. Earth-Classifying

Given a set of various rocks, the student will be able to identify the sedimentary rocks.

34. Earth-Classifying

Given a set of various rocks, the student will be able to identify the metamorphic rocks.

35. Earth-No Process

The student will be able to name the two major groups of igneous rocks and where each is formed. (volcanic-formed near or at the surface, plutonic-formed deep within the earth)

36. Earth-Inferring

Given some sandstone and shale, the student will be able to infer where each was formed and from what material it was formed. (where-under a body of water, material-compacted particles of sand in the sandstone and mud or silt in the shale)

37. Earth-Identifying Variables

Given a model of the rock cycle, the student will be able to demonstrate an application of the concept that a rock can follow many geologic paths. (Sedimentary rocks could be melted or eroded other than being metamorphised.)

38. Water-Classifying

Given a list of seven bodies of water, the student will be able to classify as oceans: the Atlantic, Pacific, Indian, and Arctic; and as seas: the Mediterranean, Caribbean, and Caspian.

GRADE FIVE OBJECTIVES
EARTH-SPACE SCIENCES

5:39-46

39. Water-Inferring

Given that settling and filtering do not remove all materials from water, the student will be able to demonstrate an application of the rule that some substances in a solution are carried by streams by listing those materials which will remain in solution. (salts, acids, and other water solubles)

40. Water-Interpreting Data

Given a drawing of the food chain in the ocean, the student will be able to explain that the food chain is important because it provides food for man.

41. Water-Inferring

Given drawings of containers of water with a layer of cold water on the bottom, the student will be able to state that in liquids of two distinct densities, the more dense will sink.

42. Water-Classifying

Given diagrams of coral reefs, the student will be able to classify each diagram as a fringing reef, barrier reef, or atoll.

43. Air-Interpreting Data

Given two diagrams of a thermometer in a liquid before and during heating, the student will be able to apply the concept that most substances expand when heated.

44. Air-Classifying

Given a choice among five gases present in our atmosphere which may vary in amount on a daily basis, the student will be able to classify water vapor as being the most important to a weatherman.

45. Air-Classifying

Given four diagrams in random order showing the vertical temperature structure of the atmosphere, the student will be able to identify the proper diagram with the appropriate atmospheric layers of (a) Troposphere, (b) Stratosphere, (c) Mesosphere, and (d) Ionosphere.

46. Water-Defining Operationally

The student will be able to define an ocean food cycle to the effect that plankton is eaten by other minute organisms which are eaten by larger animals which die and provide nutrients for plankton to make food.

GRADE FIVE OBJECTIVES
EARTH-SPACE SCIENCES

5:47-51

47. Air-Interpreting Data

Given a weather map with surface observations indicated and divided into 4-8 regions, the student will be able to apply the concept of a continental polar air mass and select the regions which are being influenced by this air mass.

48. Air-Interpreting Data

Given a map of the United States divided into regions with surface observations indicated, the student will be able to apply the concept of a maritime tropical air mass and select the regions which are being influenced by this air mass.

49. Air-Defining Operationally

Given a diagram of a jar with a hole in the end and a tube inserted, the student will be able to describe a procedure to produce condensation in the jar.

50. Air-No Process

Given that two benefits from cloud-seeding have been hail suppression and increasing rainfall, the student will be able to choose the one which is most important and state why.

51. Space-Observing

Given diagrams of geometrical curves, the student will be able to select the curve that approximates the orbit of planets.

LEVEL: GRADE FIVE

CONTENT: Biological Sciences

Variety & Pattern (Plants)

PROCESS: Experimenting

5:1

OBSERVING THE EFFECT OF TEMPERATURE ON PLANTS

OBJECTIVE #1

The student will be able to originate a design of an experiment to demonstrate how light affects the growth of plants.

ASSESSMENT #1

You have been given 4 plants in pots and a light source. Plan an experiment to determine if light affects plant growth.

RELATED ACTIVITY

Teacher Information:

Plants grow differently in varying conditions. A thermometer can be used to record the temperature of the soil.

Procedure:

1. Fill three flower pots of the same size with good soil and plant bean seeds in each.
2. Have students place one pot in an extremely cold place.
3. Have students place one pot in a moderately cool place.
4. Have students place the other pot in a warm place.
5. Label or classify these pots as cold, cool, and warm. Pour enough water in each pot to keep the soil moist.
6. Keep other environmental factors equal.
7. Observe and record the results over a ten day period.

Questions:

How would refrigeration affect the seed after germination?

MATERIALS

3 flower pots
bean seeds
soil
water
labels and markers
thermometer

LEVEL: GRADE FIVE

CONTENT: Biological Sciences

Variety & Pattern (Plants)

PROCESS: Inferring

5:2

DEMONSTRATING HOW FOSSILS ARE FORMED

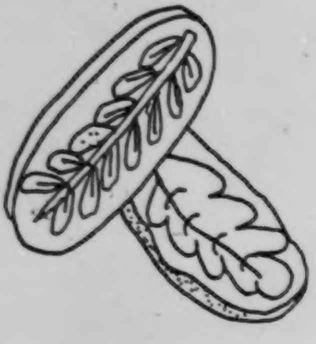
(Page 1 of 2)

OBJECTIVE #2

Given pictures of fossil plants, the student will be able to construct an inference as to how the plants became fossilized. (Students must include that the plant was deposited in a material which later became rock.)

ASSESSMENT #2

Look at this picture of a fossil. How do you think this plant became a fossil?



RELATED ACTIVITY

Teacher Information:
This demonstration shows how some fossils are formed.

Procedure:

1. Mix enough clay to cover the bottom of a box one or more inches deep.
2. Press a clam shell (curved side down) deeply into the clay.
3. Carefully lift the shell out so that a clear imprint is made.
4. Make a thick paste of plaster of Paris, adding a little salt or vinegar to prevent its hardening too quickly.
5. Pour plaster of Paris into the shell imprint.
6. When the plaster of Paris hardens, remove the cast carefully from the mold.
7. If no fossils are brought in by the students, the teacher may be able to borrow many fine specimens.
8. After a discussion, the demonstration can be done by students.
9. Since it is not possible to demonstrate actual fossilization by petrification or settlement, the teacher would need to have examples of each of these types to display.
10. During the demonstration, relate the similarity between the used materials and what they represent.
    - The clay represents the mud of the ocean bottom.
    - The plaster of Paris represents the minerals held in solution by sea water.

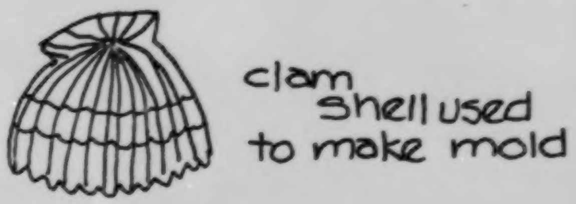
LEVEL: GRADE FIVE

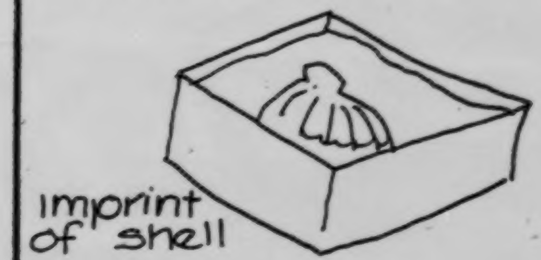
CONTENT: Biological Sciences
Variety & Pattern (Plants)

PROCESS: Inferring

5:2

DEMONSTRATING HOW FOSSILS ARE FORMED
(Page 2 of 2)


clam shell used to make mold



- The fossil cast was formed when the shell made a print of itself then decayed, leaving a space which was ultimately filled with a hard mineral material making a perfect replica of the original shell.
- The cast, represented by the plaster of Paris, was dissolved by some other minerals leaving only a hollow or mold of the shell.

Questions:
1. How could the age of a fossil be determined?
2. What animals that you know of do not exist any longer today?
3. What do you know about carbon dating?

MATERIALS
box, shell, clay, plaste
of Paris, vinegar, salt

LEVEL: GRADE FIVE

CONTENT: Biological Sciences

Variety & Pattern (Animals)

PROCESS: Classifying

5:6

OBSERVING CHARACTERISTICS OF BIRDS

(Page 1 of 2)

OBJECTIVE #6

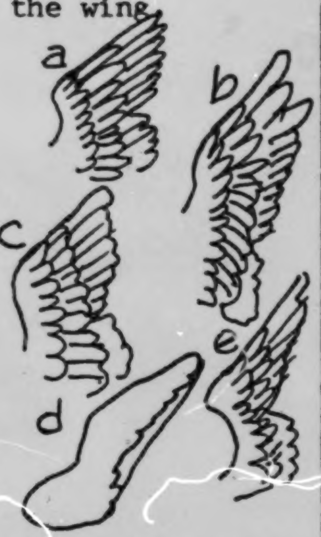
Given bird wings or drawings or pictures of bird wings and asked to identify the kinds of motion for which each wing is designed, the student will be able to classify each wing according to its physical characteristics. (Sample must include wings for soaring, speed, gliding and diving, long flights, and swimming.)

ASSESSMENT #6

Some birds soar on wind currents over a fairly small area, others fly very fast, some glide long distances and dive rapidly, some migrate very long distances, and one species of bird swims. Below are drawings of some wings and a list of birds with their flying habits.

Match the bird to the wing.

1. penguin- swims
2. Tern- glides & dives
3. Hawk- soars
4. Pigeon- speed
5. Robin- migrates very long distances



(Answers: 1. E; 2. D; 3. B; 4. C; 5. A.)

RELATED ACTIVITY

Take a bird study trip and have students write identification clues as follows:

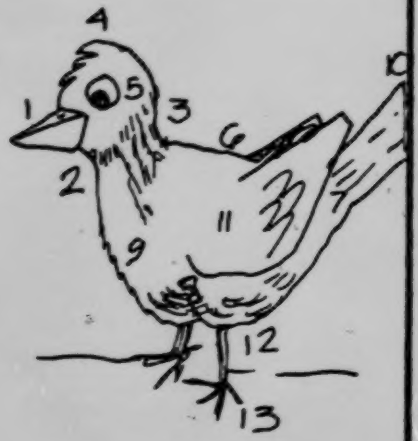
1. Coloration: Stiking colors or lack of them: contrasting color-areas; spots at tip of tail, bars on wings or tail, or both, flashed in flight; rump-patch.
2. Habitat or place where bird is found.
3. Outline and Movements: motionless-proportions of entire silhouette, of bill and shoulders, of tail to body, of head to body; hopping or running-carriage of feet, frequency of changing pose of body, various mannerisms such as twitching of wings and dipping of tail in flight-soaring, gliding, undulating, buzzing, whirring, "set" of wings.
4. Notes: various male calls, notes of both adults, food calls of the young.

LEVEL: GRADE FIVE
CONTENT: Biological Sciences
Variety & Pattern (Animals)
PROCESS: Classifying

OBSERVING CHARACTERISTICS OF BIRDS

(Page 2 of 2)

(1-beak, 2-throat, 3-nape, 4-crown, 5-eye color, 6-back, 7-rump, 8-abdomen, 9-breast, 10-tail, 11-wings, 12-legs, 13-feet)



RELATED ACTIVITY

Pupils should observe the following: beak, throat, nape, crown, eye color, back, rump, abdomen, breast, tail, wings, legs, feet.

Suggested chart for recording observations:

Name__________ Date______
Locality______ Length of Bird______
BEAK__________ Color______
Length____ Slender, wide, or hooked______
COLOR______ Most striking______
Crown______ Nape______ Back______
Rump______ Throat______ Breast______
Abdomen__ Eye streak___ Eye Color_
TAIL______ Long or short______
Square at end, V-shaped______
Pointed____ General color______
Crossbars or bands; marked by spots______ Their color______
WINGS______ Long, narrow, wing bars: none, one, or two______
Color______ Outer primaries______
Type of feathers______
Main use______ Shape______
LEGS______ Very long______
Long___ Medium___
Short______ Color______
FEET______ Webbed______
Clawed____ Color______
Length______

Questions:

1. Does the bird show flash color when flying? Explain.
2. In actions, is it slow and quiet or active and nervous? Explain.
3. Does it appear alone or in a flock?
4. Describe the method of flying.
5. Where does it sit? Where does it sing?

MATERIALS

notebook
pencil
tagboard for chart
marker

LEVEL: GRADE FIVE

CONTENT: Biological Sciences
Variety & Pattern (Microbes)

PROCESS: Interpreting Data

5:13

GROWING BACTERIA

OBJECTIVE #13

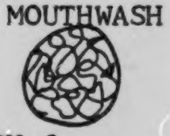
Given a pictorial representation of how bacteria found in a human's mouth responds to various mouth washes, the student will be able to generate a verbal interpretation which must include that one mouth wash is better than another because it retards the metabolism or growth or kills more bacteria than the other.

ASSESSMENT #13

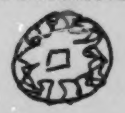
Below are pictures of 3 cultures of bacteria taken from the same person's mouth and inoculated onto a petri dish with an agar base and incubated at 40°C for 24 hours. In the middle of 2 of the dishes was placed a sterile gauze pad 1 cm x 1 cm which was soaked with a mouth wash. In the first dish nothing was added.

What conclusions or interpretations can you draw from the data below?

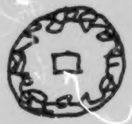
DISH 1
NO MOUTHWASH



DISH 2
MOUTHWASH X



DISH 3
MOUTHWASH Y



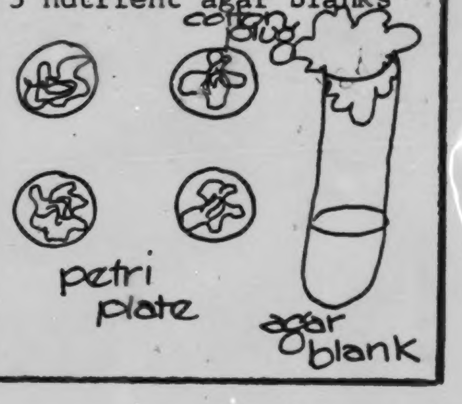
RELATED ACTIVITY

Procedure:

1. In a water bath melt agar blanks.
2. Pour agar into Petri plates, taking care not to expose to air.
3. Invert Petri plates and allow to set.
4. Divide one plate into quarters by making marks with a pencil.
5. Taking care not to expose to air longer than necessary, have four students place the tips of fingers in each of the four quarters. Re-cover the plate.
6. Have one student cough into the second Petri plate and re-cover.
7. Leave third Petri dish unexposed.
8. Incubate all Petri dishes at 40°C for 24 hours.
9. Describe the results and their implications for personal health habits.

MATERIALS

3 Petri plates
3 nutrient agar blanks



LEVEL: GRADE FIVE
CONTENT: Biological Sciences
Survival & Adaptation
PROCESS: Identifying Variables

5:14

TESTING THE EFFECTS OF VARIOUS FACTORS

OBJECTIVE #14
Given environmental conditions for seed growth, the student will be able to predict success of growth.

ASSESSMENT #14
If you planted bean seeds in cups with the following soil, light, and watering conditions, which would you expect to grow best, next best, poorest. Put them in order from what you think would be the most successful to the least successful.

1. in good soil, in good light, watered every day
2. in good soil, in good light, watered every other day
3. in good soil, in good light, watered every fifth day
4. in good soil, in shade light, watered every other day
5. in good soil, in good light, teaspoon of vinegar every day
6. in sand, in good light, watered every day
7. in good soil, in good light, watered once
8. in good soil, in good light, soaked continually

(Answers: 2; 1; 6; 3; 4; 8; 7; 5.)

RELATED ACTIVITY
One kind of seed should be used throughout this activity. Students will test the effects of 4 different factors on germination. When testing one factor, students should remember to keep the other 3 factors the same.

Procedure:

1. Place a blotter or layer of absorbent cotton in the bottom of each of eight dishes. Place 4 seeds on the top of the inside of each dish. Use 2 dishes for each of the four factors. (Students should be encouraged to suggest and test for the effects of other factors.)
   Water Test: Water seeds in dish #1, but do not water dish #2.
   Temperature Test: Keep seeds in #3 in a pan of ice water and seeds in #4 in a warm place.
   Light Test: Put seeds in #5 in a dark place and seeds in #6 in a sunny window.
   Air Test: Leave seeds in #7 open to the air but put a sheet of glass or clear plastic over seeds in #8.
2. Chart and describe the results. Generalize.

MATERIALS
32 seeds of the same variety
8 saucers
2 pieces of glass or plastic
cotton or blotter
rectangular cake pan
water

LEVEL: GRADE FIVE

CONTENT: Physical Sciences

Matter

PROCESS: Formulating Hypotheses

5:18

DESCRIBING THE PROCESS OF RUSTING

OBJECTIVE #18

Given a description of what happens to steel wool left in an inverted tube of water, the student will be able to state a hypothesis to account for the observed changes. (As the steel wool rusts, the water level rises in the tube. Rusting takes up oxygen. As the oxygen from the air combines with the steel wool (iron), the oxygen is replaced by water.)

ASSESSMENT #18

Imagine a piece of wet steel wool (iron) packed loosely at the bottom of a test tube. The test tube is turned upside down and put in a beaker of water and the height of the water is marked. After a period of time, the steel wool becomes rusted. Also, the water goes higher into the test tube. Explain why the water level gets higher as the steel wool rusts.

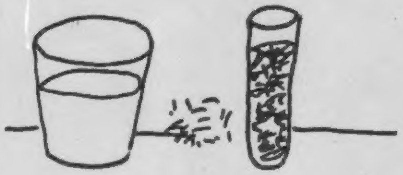
RELATED ACTIVITY

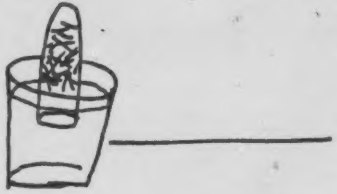
Procedure:

1. Wet the inside of a test tube.
2. Place some iron filings (or steel wool) in the test tube.
3. Invert the test tube and place it in a tumbler of water. (No water enters the test tube because it is full of air.)
4. Allow the glass of water and test tube to stand until the following day. (The iron filings (or steel wool) will become rusted and the water rises in the test tube about one-fifth of the way.)
5. Describe and explain the results. (Air contains oxygen. The oxygen of the air in the test tube combined with the iron filings, thus removing the oxygen from the air. Water rose in the tube, taking the place of oxygen, showing that about one-fifth of air is oxygen.)

MATERIALS

glass tumbler
test tube
iron filings or
steel wool
water





LEVEL: GRADE FIVE

CONTENT: Physical Sciences

Matter

PROCESS: Classifying

5:19

DESCRIBING ELEMENTS AND COMPOUNDS

OBJECTIVE #19

Given a list of elements and compounds, the student will be able to list each separately. (water, oxygen, silver, baking soda, vinegar, nitrogen, copper, etc.)

ASSESSMENT #19

Here is a list of elements and compounds. Make a list of the substances that are elements and a list of the substances that are compounds.

water
oxygen
baking soda
vinegar
silver
sugar
nitrogen
copper
nickel
alcohol

(Answers: Elements: oxygen silver, nitrogen, copper, nickel; Compounds: water, baking soda, vinegar, sugar, alcohol)

RELATED ACTIVITY

Teacher Information:

Heat is one method of extracting elements from their compounds. In this instance, metal is extracted from ore.

Procedure:

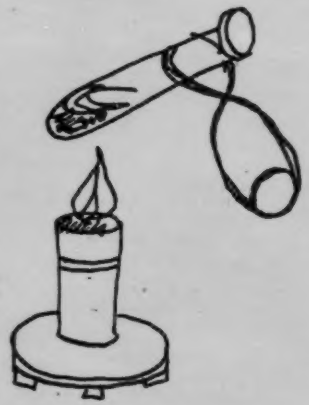
1. Put several grains of mercuric oxide into a glass test tube.
2. Heat the test tube over a Bunsen burner flame.
3. Cool the upper part of the tube with a wet cloth.
4. Describe the results. (A silvery substance called mercury collects on top.)

Questions:

1. What is the difference between chemical and physical change?
2. When mercury combines with oxygen, is any gas given off?

MATERIALS

several grains of mercuric oxide
glass test tube
Bunsen burner or some other type of flame
wet cloth
test tube holder



LEVEL: GRADE FIVE

CONTENT: Physical Sciences

Matter

PROCESS: Inferring

5:20

DESCRIBING A MIXTURE AND A COMPOUND

OBJECTIVE #20

Given information that a magnet separates the iron from an unheated mixture of iron and sulfur but will not in a heated mixture, the student will be able to state that the heat has caused the iron and sulfur to change from a mixture to a compound with different properties, one of them being that it is no longer magnetic.

ASSESSMENT #20

In a container of iron and sulfur, a magnet will separate the iron from the sulfur. In a container of iron and sulfur that has been heated, the magnet will not separate the iron from the sulfur. Using this information, explain why the iron and sulfur that has been heated no longer has magnetic properties.

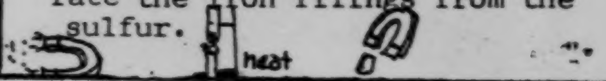
RELATED ACTIVITY

Teacher Information:

A mixture is the mixing together of two or more elements with each element retaining its individual properties. A compound is the union of two or more elements with a chemical change and each element no longer has its original characteristics.

Procedure:

1. Mix sulfur and iron filings in a test tube.
2. Shake the two elements together.
3. Pour them out onto a saucer.
4. Using a magnet, separate the iron filings from the sulfur.
5. Put twice as much sulfur as iron filings into a second test tube.
6. Heat this one over a hot plate or burner.
7. Cool.
8. Break the test tube and remove the material from it.
9. Using the magnet, try to separate the iron filings from the sulfur.



Results:

When the iron and sulfur were mixed in the first test tube, the magnet attracted all the iron filings. When the iron and sulfur were mixed in the second test tube and heated, a change in color occurred. The magnet was unable to separate the iron filings from the sulfur.

Questions:

1. How do we know a chemical change has taken place?
2. What is the difference between a chemical change and a physical change?
3. Why won't the magnet attract the iron sulphide compound?

MATERIALS

sulfur powder, iron filings, 2 test tubes, magnet, burner, saucer

LEVEL: GRADE FIVE

CONTENT: Earth-Space Sciences

Water

PROCESS: Inferring

5:39

MEASURING THE AMOUNT OF SILT IN WATER*

OBJECTIVE #39

Given that settling and filtering do not remove all materials from water, the student will be able to demonstrate an application of the rule that some substances in a solution are carried by streams by listing those materials which will remain in solution. (salts, acids, and other water solubles)

ASSESSMENT #39

Not all substances can be removed from water by filtering and settling. List three and state why they cannot be removed in this way. (Water solubles dissolve and will remain in water.)

RELATED ACTIVITY

Students will identify pollutants in a body of water, measure the effect of silt on visibility in water, and describe the results of settling.

Procedure:

1. Visit a stream, pond, or canal near the school. (Adequate supervision and safety precautions are required.)
2. Ask students to identify and describe in written form the various kinds of pollutants they find. Indicate that water may be polluted by large amounts of silt.
3. Using a white plastic jar top, punch three holes, evenly spaced, around the rim of the lid. Tie a piece of string to each hole and tie the other ends to a cord five to ten feet long.
4. Help the students to lower the cover into the water until it just disappears. Record the depth by measuring the length of wet cord. Take readings from different areas.
5. Have students collect quarts of water from different locations and allow to sit overnight.
6. Describe the results.

MATERIALS

paper and pencil for recording observations for each different area measured:
  white plastic jar top
  3 pieces of string
  1 cord 5 to 10 feet long for top
  clear glass quart container with top
  1 cord 5 to 10 feet long for quart container
instrument for punching holes in jar tops

*"How Water Is Polluted," Science in City and Surburb (Middletown, Conn.: American Publications, 1969).

GRADE FIVE RELATED MATERIALS 5:1-7

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
1. Demonstrating the effect of light on plants.	OBSERVING THE EFFECT OF TEMPERATURE ON PLANTS		Pt. 5: 173-180			
2. Inferring how plants became fossilized.	DEMONSTRATING HOW FOSSILS ARE FORMED	5:158-173 6:158-159 6:223				
3. Identifying algae, moss, fern, fungi, grass, seeds.		5:79-82 6:298-301				
4. Describing the effect of exposure on loss of moisture.		6:32-33	Pt. 4: 179-183 Pt. 5: 13-28	4:49-54		
5. Graphing data in regard to nicotine comsumption.						
6. Classifying bird wings according to function.	OBSERVING CHARACTERISTICS OF BIRDS	5:50-51				
7. Describing hibernation in amphibians.						

GRADE FIVE RELATED MATERIALS 5:8-14

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
8. Determining the effect of insect body size on running speed.		5:64-65	Pt. 3: 21-25			
9. Classifying bird feet according to function.		5:50-51	Pt. 3: 21-25 Pt. 4: 23-32			
10. Classifying bird beaks according to function.		5:50-51	Pt. 4: 23-32			
11. Identifying how microbes move from place to place.		5:83 6:167	Pt. 3: 49-55			
12. Inferring the reasons for killing microorganisms.		5:82-83				
13. Describing the effect of mouth washes on mouth bacteria.	GROWING BACTERIA		Pt. 3: 49-55			
14. Predicting the success of seed growth.	TESTING THE EFFECTS OF VARIOUS FACTORS ON SEED GROWTH	6:168		5:321-341 6:18-40		

GRADE FIVE RELATED MATERIALS

5:15-21

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
15. Identifying the variables of the predator-prey population size.		5:306-309 6:232-241				
16. Measuring lung capacity before and after active exercise.		4:167-173				
17. Choosing to speak for protecting endangered animals.		6:156-163 6:274-275 6:284-287				
18. Describing what happens to steel wool left in an inverted tube of water.	DESCRIBING THE PROCESS OF RUSTING	5:234	Pt. 7: 119-126			
19. Classifying elements and compounds.	DESCRIBING ELEMENTS AND COMPOUNDS	5:247				
20. Changing from a mixture to a compound.	DESCRIBING A MIXTURE AND A COMPOUND	5:249	Pt. 6: 211-220			
21. Identifying statements concerning states and changes of matter.		5:230-231 6:268-272		4:32-48 4:200-209 4:296-304 4:305-341		

GRADE FIVE RELATED MATERIALS 5:22-28

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
22. Identifying statements concerning atoms, molecules, elements, etc.		5:240-246		4:253-281		
23. Stating dissolving time decreases as temperature increases.			Pt. 6: 201-209	4:116-158 4:188-199		
24. Describing the continuous random motion of molecules.		4:163-166		4:296-316 5:140-155 6:343-361		
25. Stating an operational definition of a solution.			Pt. 5: 105-112	3:40-61 5:171-189		
26. Classifying granular substances according to shape.		5:220-222	Pt. 7: 249-253	3:40-49 5:127-155 6:176-187		
27. Determining the speed of an object in seconds.			Pt. 5: 29-36			
28. Determining the efficiency of the location of a fulcrum.		6:102-131				

GRADE FIVE RELATED MATERIALS

5:29-35

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
29. Classifying force evidenced by heat as frictional.		4:149-150 4:246-251 6:102-131				
30. Suggesting unique ways of utilizing natural energy.		4:263-271		5:204-258		
31. Inferring how solids build up on the bottoms of lakes, etc.		4:21-28 6:196-198 6:296-299				
32. Demonstrating how South America and Africa were once joined.						
33. Identifying sedimentary rocks.		5:152-181				
34. Identifying metamorphic rocks.						
35. Naming 2 groups of igneous rocks and where each is formed.						

GRADE FIVE RELATED MATERIALS 5:36-42

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
36. Inferring where and from what materials sandstone and shale are formed.		5:154-157 6:206	Pt. 4: 9-21			
37. Explaining that a rock can follow many geologic paths.						
38. Classifying oceans and seas.		4:16-20				
39. Listing the materials in streams which remain in solution.	MEASURING THE AMOUNT OF SILT IN WATER	4:21-28 6:196-198 6:294-295	Pt. 5: 105-112			
40. Explaining why the ocean food chain is important to man.		5:144-151				
41. Indicating that the denser of two liquids will sink.		5:118-123				
42. Classifying fringing reef, barrier reef, and atoll.						

GRADE FIVE RELATED MATERIALS 5:43-49

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
43. Indicating that most substances expand when heated.		5:120 5:231-232	Pt. 4: 131-139			
44. Classifying water vapor as most important to weathermen.		5:124-125 6:37-48 6:62-67				
45. Identifying the vertical temperature of atmospheric layers.						
46. Indicating an operational definition of an ocean food cycle.		5:310-311				
47. Selecting the weather map regions influenced by a continental polar air mass.		5:131				
48. Selecting the weather map regions influenced by a maritime tropical air mass.		5:131				
49. Describing a procedure to produce condensation in a jar.		6:32-37 6:46				

GRADE FIVE RELATED MATERIALS

5:50-51

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
50. Choosing the most important benefit from cloud seeding.		6:56-61				
51. Selecting a curve that approximates the orbit of planets.		6:93-99				

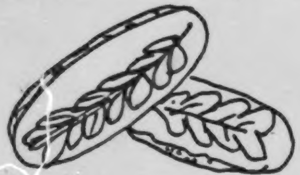
GRADE FIVE ASSESSMENT ITEMS

BIOLOGICAL SCIENCES

5:1-4

1. Provide 4 plants in pots and a light source. Say: You have been given 4 plants in pots and a light source. Plan an experiment to determine if light affects plant growth. (The experiment must include the listing of 3 controlled variables, the manipulated variable in each test, and the responding variable in each test.)

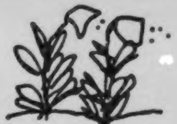
2. Look at this picture of a fossil. How do you think this plant became a fossil? (The inference must include that the plant was deposited in a material which later became rock.)

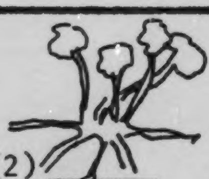


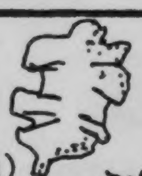
3. Match the name with the picture by placing the correct letter on the line under each picture.

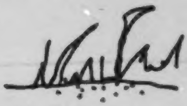
A. moss	D. fungi
B. algae	E. grass
C. seed plant	F. fern

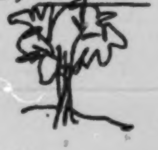
(Answers: 1-A, 2-D, 3-B, 4-E, 5-C, 6-F.)

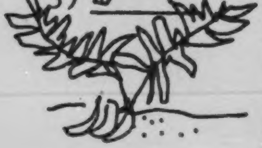

(1) ______


(2) ______


(3) ______

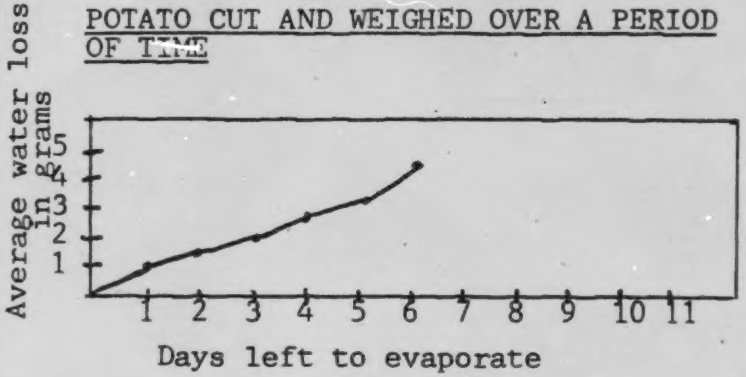

(4) ______


(5) ______


(6) ______

4. Given the information on the graph below, plot what you would predict the water loss would be on days 8 and 9. What generalization could you state as to what will happen to vegetables cut and left in the open?

POTATO CUT AND WEIGHED OVER A PERIOD OF TIME



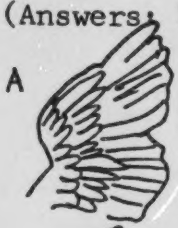
GRADE FIVE ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

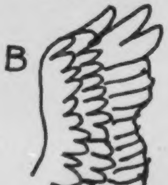
5. An average person smoking a cigarette is turning a poison, nicotine, into both the atmosphere and himself. About 60% of the nicotine in a cigarette is burned during the smoking of the cigarette. About 30% of the nicotine is exhaled with the smoke and about 10% is retained by the body. Construct a graph which shows what happens to 100% of the nicotine in a cigarette. (The graph must include a title, a scale on each axis, the axes being labeled, the scales being on the lines and not in the spaces and the points or bars being in the correct positions.)

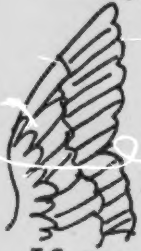
6. Some birds soar on wind currents over a fairly small area, others fly fast, some glide long distances and dive rapidly, some migrate very long distances and one species of bird swims. Below are drawings of some wings and a list of birds with their flying habits. Match the bird to the wing by placing the correct letter on the line next to each kind of bird.

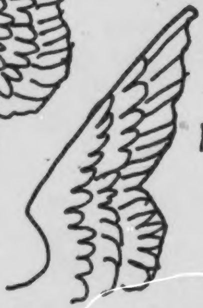
_____(1) penguin - swims
_____(2) tern - glides and dives
_____(3) hawk - soars
_____(4) pigeon - speed
_____(5) robin - migrates long distances

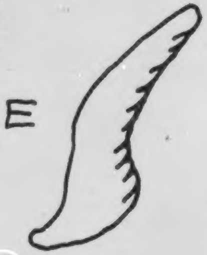
(Answers: 1-E, 2-D, 3-B, 4-C, 5-A.)

A


B


C


D


E


7. If you were a frog living in a small pond and the weather turned cold, it started to snow, and the pond water began to freeze, describe what you would do and what would happen to you. (Explanation must include finding shelter or burrowing in the mud and reducing at least one of the following life processes: growth; metabolism such as digestive, respiratory, or circulatory systems; reproduction; and movement.)

GRADE FIVE ASSESSMENT ITEMS

BIOLOGICAL SCIENCES

5:8-9

8. An entomologist, a person who studies insects, states the following hypothesis: Insects with long bodies can run faster than insects with shorter bodies. Another entomologist disagreed with him. Your task is to design an experiment to gather enough information to accept, reject, or modify the stated hypothesis. Write a detailed description of what your experiment would be and what you would do. (The design of the experiment must include the following: the manipulated, variable is the length of insect body; the responding variable is how fast the insect runs; a procedure for manipulating the variables and those variables held constant during each manipulation; operational definitions for at least the terms 'long bodies' and 'faster'; materials needed; and methods for collecting and interpreting data.)

9. Below are the names of 5 birds and how they use their feet. Match the drawings of the bird feet to the bird by placing the correct letter next to the bird name.

(Answers: 1-C, 2-D, 3-E, 4-B, 5-A.)

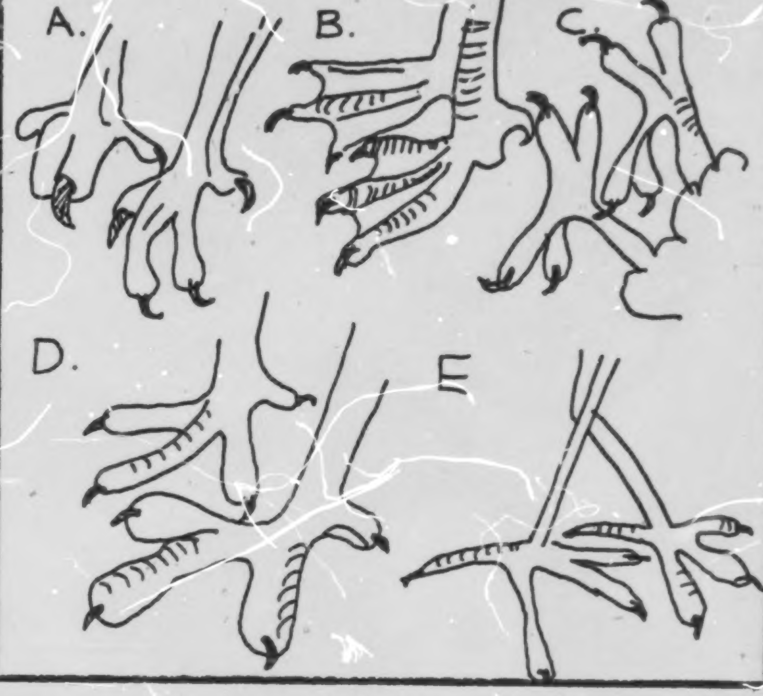
_____(1) woodpecker - climbs up and down trees

_____(2) ostrich - doesn't fly, but can run great distances

_____(3) swift - grasps its prey and flies away

_____(4) duck - swims around in the water

_____(5) chicken - scratches and stands around eating off the ground

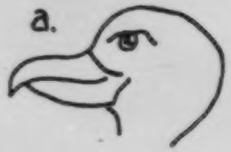


GRADE FIVE ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

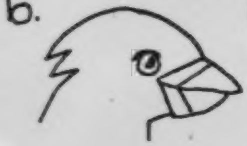
5:10-12

10. Some birds eat seeds, nuts, and other hard types of food. Place a check next to the pictures of those that eat hard types of food. (Answers: B, E.)

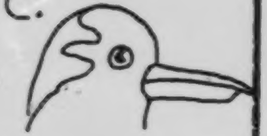
a.



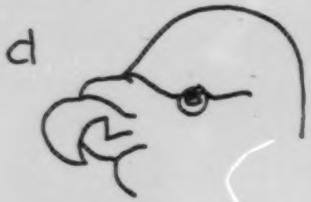
b.



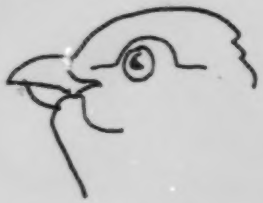
c.



d



e.



(Optional Assessment
Some birds eat by tearing their food into pieces. In the picture above, place an X next to the birds that eat by tearing their food into pieces.

Answers: D.)

11. Microbes are found all over the world. They employ different methods for getting from place to place. Place an X next to those methods below which microbes employ for movement. (Answers: all methods should be marked.)

_____(1) riding air currents
_____(2) attaching to boats, planes, and cars
_____(3) riding inside a person
_____(4) riding on an animal
_____(5) floating on ocean currents

12. What is the reason for all of the following actions?

(1) A hiker boils the water from a stream before drinking it

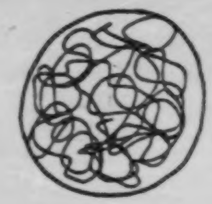
(2) A lifeguard puts chlorine in a swimming pool.

(3) A person puts iodine on an open cut.

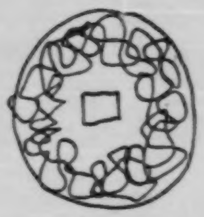
(All of these actions serve to kill microorganisms that may be harmful to man.)

13. Below are pictures of three cultures of bacteria taken from the same person's mouth and inoculated onto a petri dish with an agar base and incubated at 40°C for 24 hours. In the middle of two of the dishes was placed a sterile gauze pad 1 cm. x 1 cm. which was soaked with a mouth wash. In the first dish nothing was added. What conclusions or interpretations can you draw from the data below?

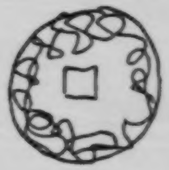
DISH 1
NO MOUTHWASH



DISH 2
MOUTHWASH X



DISH 3
MOUTHWASH Y



(One mouthwash is better than the other because it retards the metabolism or growth or kills more bacteria than the other.)

14. If you planted bean seeds in cups with the following soil, light, and watering conditions, which would you expect to grow best, next best, poorest. Place them in numerical order of 1 to 8 from what you think would be the most successful to the least successful.

___(A) in good soil, in good light, watered every day
___(B) in good soil, in good light, watered every other day
___(C) in good soil, in good light watered every fifth day
___(D) in good soil, in shade light watered every other day
___(E) in good soil, in good light, teaspoon of vinegar every day
___(F) in sand, in good light, watered once
___(G) in good soil, in good light, watered once
___(H) in good soil, in good light, soaked continually

(Answers: 2-A, 1-B, 4-C, 5-D, 8-E, 3-F, 7-G, 6-H.)

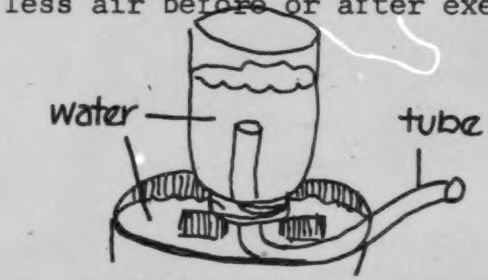
GRADE FIVE ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

5:15-17

15. In Florida, there are many trees, and many of these trees are pine trees. Florida seems to be a good place for pine trees to grow because there is plenty of water close to the surface of the ground, and the pine tree's roots do not have to go very deep to get the water. However, many pine trees are killed each year by an insect known as the pine beetle which feeds off the pine tree. This beetle survives well in Florida because of the warm, moist climate. Man also helps the pine trees by burning out the undergrowth in pine forests and planting more trees when they cut some down. Therefore, the population of pine trees in Florida has increased over the past fifty years. However, in the mountains of North Texas, the pine tree population has decreased over the past fifty years. Based on the information given, state why the population of pine trees in the North Texas Mountains has decreased.

(Answer: no water close to surface, weather too cold for pine beetle, trees not planted by man.)

16. Set up the materials according to the drawing. Be sure to fill the jug completely with water. Fill your lungs completely and exhale into the tube. Measure from the top of the jug to the water level and record your findings. Refill the jug and repeat the experiment after running in place for three minutes. Do your lungs hold less air before or after exercise?



17. The following list of animals are on our endangered species list. They are in danger of being eliminated from the earth. What should we do about the problem?

(1) bald eagle
(2) blue whale
(3) California condor
(4) Everglades kite
(5) Bengal tiger
(6) red wolf
(7) key deer
(8) whooping crane
(9) cougar
(10) alligator

(Answer: Student favors protecting the animals.)

GRADE FIVE ASSESSMENT ITEMS
PHYSICAL SCIENCES

18. Imagine a piece of wet steel wool (iron) packed loosely in the bottom of a test tube. The test tube is turned upside down and put in a beaker of water and the height of the water inside the tube is marked. After a period of time, the steel wool becomes rusted. Also, the water goes higher into the test tube. Explain why the water level gets higher as the steel wool rusts.

(Answer: Oxygen is one of the gases in air. Rusting takes up oxygen. As oxygen from the air combines with the steel wool (iron), the oxygen is replaced by water.)

19. Here is a list of elements and compounds:

water
oxygen
silver
baking soda
vinegar

sugar
nitrogen
copper
nickel
alcohol

Make a list of the substances that are elements and a list of the substances that are compounds.

(Answers: Elements - oxygen, silver, nitrogen, copper, nickel; Compounds - water, baking soda, vinegar, sugar, alcohol.)

20. In a container of iron and sulfur, a magnet will separate the iron from the sulfur. In a container of iron and sulfur that has been heated, a magnet will not separate the iron from the sulfur. Why does the heated container of iron and sulfur no longer have magnetic properties?

(Answer: The heat caused the iron and sulfur to change from a mixture to a compound with different properties, one of them being that it is no longer magnetic.)

21. Here is a list of statements about the states of matter and the changes of matter. Put a check by each statement which is true.

___(1) When matter changes from one form to another, the total amount of matter remains unchanged.
___(2) All matter can be seen with the eye.
___(3) Matter can be changed physically or chemically.
___(4) Matter can take the form of a solid, liquid, or gas.
___(5) Matter does not take up space.

(Answers: 1, 3, 4.)

GRADE FIVE ASSESSMENT ITEMS

5:22-23

PHYSICAL SCIENCES

22. The statements below are about atoms, molecules, elements, mixtures, solutions, and compounds. Put an X beside each statement that you think is correct.

___(1) Atoms combine in many ways to form molecules.
___(2) An element is composed of only one kind of atom.
___(3) Solutions are a special class of compounds.
___(4) There are spaces between all of the atoms and molecules which make up the universe.
___(5) In a solution, the solvent is the substance which is dissolved.
___(6) A mixture is made up of at least two substances.
___(7) Elements combine in definite proportions to form compounds.
___(8) In all true solutions, the solute can be distinguished from the solvent.
___(9) The amount of space between molecules is constant.
__(10) The particles of each substance of a mixture remain intact.

(Answers: 1, 2, 4, 6, 7, 10.)

23. Using a clear beaker, a stirring rod, two saccharin tablets, a thermometer graduated in degrees Celsius, a stopwatch, a water supply, and a chart depicting the relationship between dissolving time in seconds and the initial temperature of water in degrees Celsius; find out the dissolving time for one saccharin tablet in water at temperatures of 30° and 55°C. You can obtain water at various temperatures from the sink. Record the data on the chart below.

Initial temperature of water in degrees Celsius	Dissolving time, in seconds
30°	
55°	

(Answers: The value for dissolving is not important but, rather, that the value at 55 degrees C is less than the value at 30 degrees C.)

Write a hypothesis about the relationship between the temperature of the water and the dissolving time of a saccharin tablet.

GRADE FIVE ASSESSMENT ITEMS
PHYSICAL SCIENCES

5:24-26

24. Provide a demonstration in which one drop of ink is added to a glass of non-moving water. Say: You have seen me put one drop of ink into this glass of water. How can you explain the spread of the ink throughout the water?

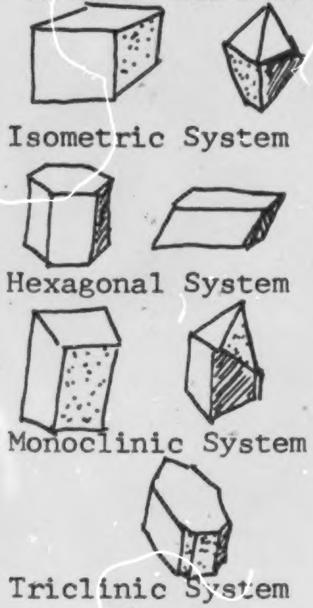
(Answer: There is a continuous random motion of particles suspended in a liquid or gas due to molecular motion.

25. Provide a demonstration where equal amounts (e.g., 5-10 grams) of baking soda and talc are mixed with equal amounts of water (e.g., 50 ml) in two labeled clear containers. After allowing time to observe, both mixtures are passed through a piece of filter paper. Say: You have watched me work with two mixtures. The mixture containing the talc and water is not a solution. However, the mixture of baking soda and water is a solution. Write an operational definition of a solution.

(Answer: A solution is a mixture in which the solid particles are no longer visible and cannot be separated from the water by filter paper.)

26. I have given you three samples of solids (e.g., salt, alum, Epsom salt) and a diagram of crystal systems. Arrange them on your desk according to the crystal system to which they belong. A magnifier has been provided to aid in the identification.

CRYSTAL SHAPE SYSTEMS



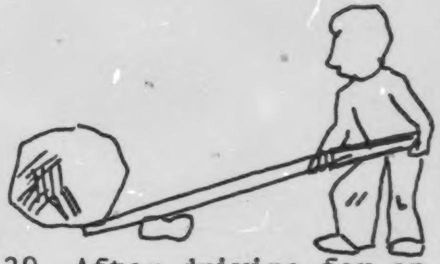
(Answers: salt and alum - isometric; Epsom salt - hexagonal.)

27. Using these materials (e.g., a marble, an elevated track at least six feet long marked in units, and a clock that can measure time in seconds), measure the time it takes the marble to roll down the track. Write the speed the marble was traveling in this blank_______________.

(Answer: Student will apply the concept that speed is the distance moved per unit of time.)

28. Provide a pint milk carton about half filled with sand, a ruler to be used as a lever, a spring scale, and a wooden block to be used as the fulcrum. Say: You have been given a diagram of a lever system, and you have materials to make a lever system like the picture. Make a lever system like the one in the picture. By moving the fulcrum, find out if the load is easier to move when the fulcrum is near the load or when the fulcrum is near the force.

(The materials are manipulated by measuring the force when the fulcrum is located near the load and when the fulcrum is located near the effort force.)



29. After driving for an hour at a high rate of speed, the tires of your car become warm. What force is acting on the tires to produce this warmth?

(Answer: friction.)

GRADE FIVE ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

5:30-35

30. Here is a list of natural energy sources. Choose two of them and suggest some new or different ways they might be utilized by man.

    solar
    gravity
    wind
    waves
    convection
    currents
    precipitation runoff
    tides
    tidal currents
    volcanoes
    hot springs

31. How do you think solids build up on the bottoms of lakes, rivers, and oceans?

    (Solids build up on the bottoms of lakes, oceans, and rivers through the process of sedimentation.)

32. Provide an outline map showing South America and Africa and a pair of scissors. Say: Using the materials provided, what can you show about the geologic relationship of the two continents?

    (Answer: The two continents were once a single continent is demonstrated by fitting the eastern edge of South America against the western edge of Africa.)

33. Provide 3 igneous rocks, 3 sedimentary rocks, and 3 metamorphic rocks. Say: Choose the sedimentary rocks in this pile of rocks.

34. Provide 3 igneous rocks, 3 sedimentary rocks, and 3 metamorphic rocks. Say: Choose the metamorphic rocks in this pile of rocks.

35. Complete the following chart.

    TWO KINDS OF IGNEOUS ROCKS:

    ____

    (1) Kind of Igneous Rock ______________

    ____

    Where It Is Formed ______________

    ____

    2. Kind of Igneous Rock ______________

    ____

    Where It Is Formed ______________

    ____

    ____

    (Answers: Volcanic rocks form near or at the surface, while plutonic rocks form deep within the earth.)

GRADE FIVE ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

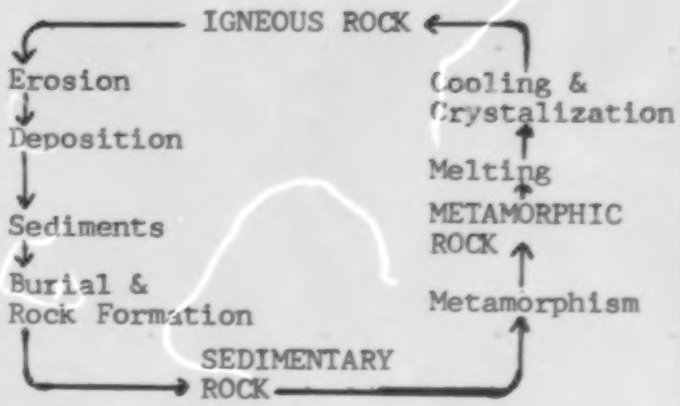
36. Provide a piece of sandstone and a piece of shale. Say: After observing these two rocks, complete the chart below.

Rock #	Where was the rock formed?	Main Ingredient
(1) Sandstone		
(2) Shale		

(Answers: The rocks both appear to have been formed under a body of water. The sandstone appears to be compacted particles of sand, while the shale appears to be formed of mud or silt.)

37. This chart illustrates the rock cycle. By using additional arrows, show at least two other paths for sedimentary rocks in the cycle other than sedimentary rock being metamorphised.

(Answers: Sedimentary rocks could be melted or eroded other than being metamorphised.)


IGNEOUS ROCK
Erosion
Deposition
Sediments
Burial &
Rock Formation
SEDIMENTARY
ROCK
Metamorphism
METAMORPHIC
ROCK
Melting
Cooling &
Crystalization

38. Write beside the name of each body of water whether it is an ocean or sea.

a. Atlantic____________________

b. Mediterranean____________________

c. Indian____________________

d. Arctic____________________

e. Caspian____________________

f. Pacific____________________

g. Caribbean____________________

(Answers: Oceans - Atlantic, Pacific, Indian, Arctic; Seas - Mediterranean, Caribbean, Caspian.)

GRADE FIVE ASSESSMENT ITEMS

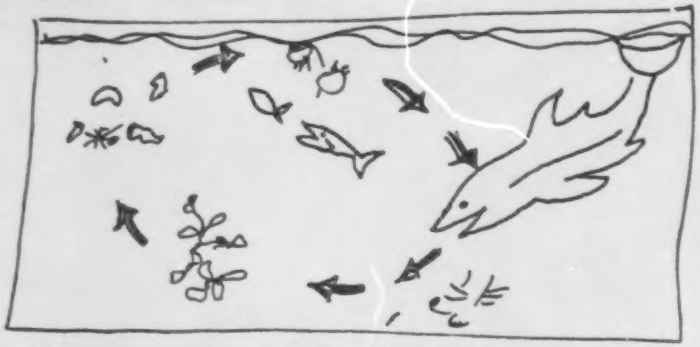
5:39-42

EARTH-SPACE SCIENCES

39. Not all substances can be removed from water by filtering and settling. List three and state why they cannot be removed in this way.

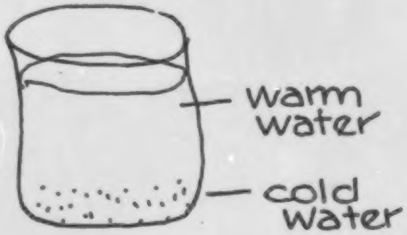
(Answer: Some substances are carried by streams in solution (salts, acids, and other water solubles) because those materials which dissolve in water will remain in the water.)

40. This is an illustration of the food chain in the ocean. Explain how this is important to man.



(Answer: The food chain is important because it provides food for man.)

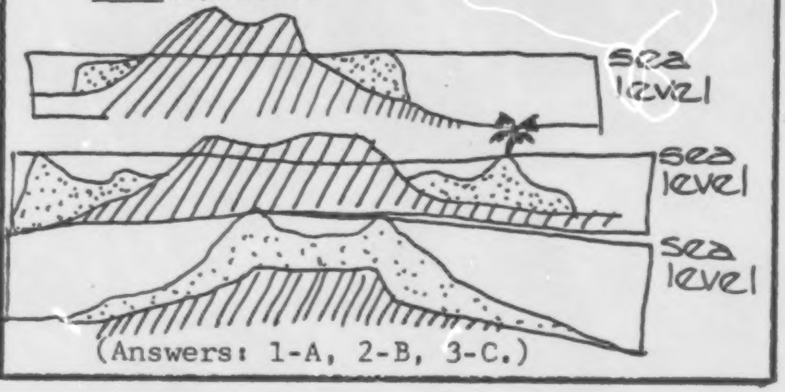
41. Look at the drawing below. Why is the colder water at the bottom?



(Answer: In liquids of two distinct densities, the more dense will sink.)

42. Which diagram is a representation of a:

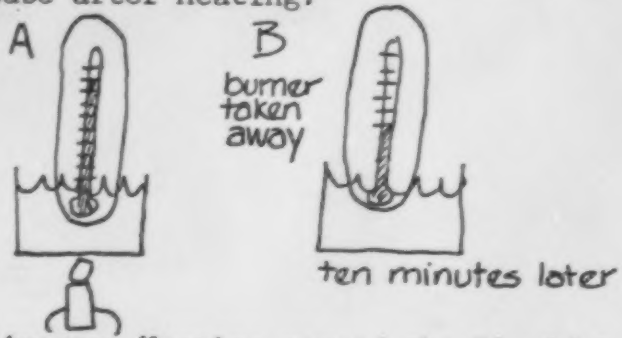
____(1) fringing reef
____(2) barrier reef
____(3) atoll



(Answers: 1-A, 2-B, 3-C.)

GRADE FIVE ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

43. The two diagrams show a thermometer before and after heating. Why is the liquid in the thermometer higher in the tube after heating?



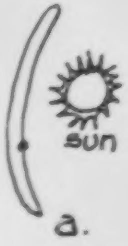
(Answer: Heating caused the liquid to expand, and, since no other expansion direction was available, the liquid went up in the thermometer.)

44. Gases in the atmosphere vary in amount on a daily basis. Of the gases listed below, place an X next to the one whose amount is most important to a weatherman.

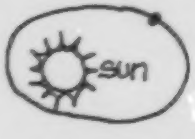
____(1) carbon dioxide
____(2) water vapor
____(3) sulphur
____(4) nitrogen
____(5) hydrogen

(Answer: #2.)

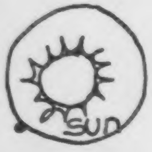
45. Place an X next to the diagram which best illustrates the vertical temperature change in the stratosphere.



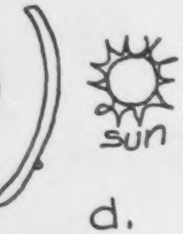
a.



b.



c.



d.

(Answer: The diagram which shows the temperature remaining constant then increasing with height indicates the stratosphere - #1.)

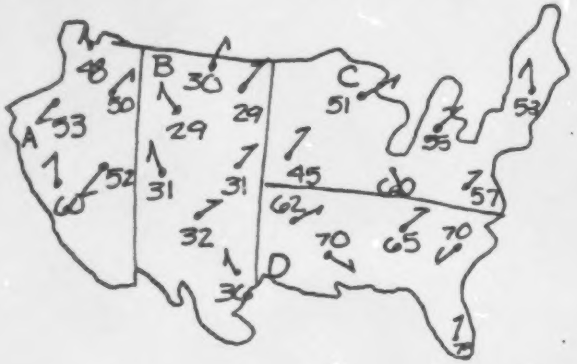
46. Define operationally an ocean food cycle. (Answer: Plankton are eaten by other minute organisms which are eaten by larger invertebrates and minnows which are eaten by larger animals and fish, etc., which in turn die and provide nutrients for plankton.)

GRADE FIVE ASSESSMENT ITEMS

5:47-50

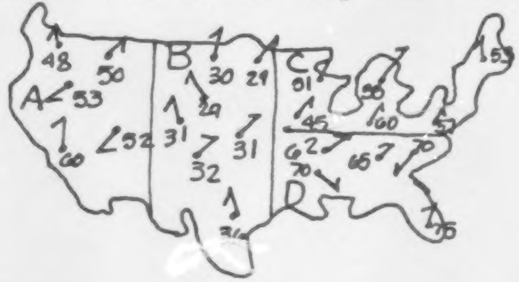
EARTH-SPACE SCIENCES

47. On the weather map provided, underline the regions which are under the influence of a continental polar air mass.


A
B
C
D
48
50
53
52
60
30
29
29
31
31
32
36
51
45
60
62
70
65
70
55
53
57
75

(Answer: Region B.)

48. On the weather map provided, underline the regions which are under the influence of a maritime tropical air mass.


A
B
C
D
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60
52
31
29
30
21
31
32
31
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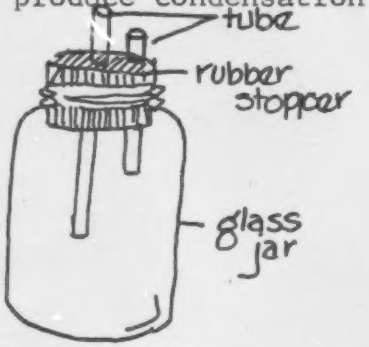
45
56
60
57
53
62
70
65
70
75

(Answer: 1 and 2 D.)

49. With the apparatus in the diagram, how could you produce condensation in the jar?

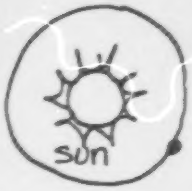

tube
rubber stopper
glass jar

(Answer: Condensation can be produced in the jar by either (1) putting more water vapor in the jar by blowing gently in the inserted tube or (2) closing the tube opening and cooling the jar.)

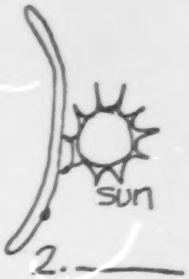
50. Cloud-seeding can have positive results in the forms of hail suppression and increased rainfall. Choose the result that is more important, and state the reasons for the choice.

51. Place a check mark below the diagram that you think shows the path that planets follow as they travel about the sun.

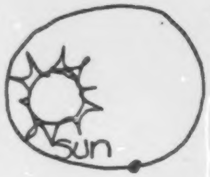
(Answer: The student marks the diagram of an ellipse - #3.)



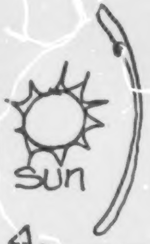
1. ____



2. ____



3. ____



4. ____

GRADE SIX OBJECTIVES

6:1-7

BIOLOGICAL SCIENCES

1. Variety & Pattern (Plants)-Experimenting

   Given a hypothesis about water loss in plants and asked to identify the manipulated and responding variables in a test of the hypothesis, the student will be able to identify them by stating the identification of what both variables are.

2. Variety & Pattern (Animals)-Classifying

   Given a drawing of a cell with the cell membrane, cytoplasm, nuclear membrane, nucleus, and vacuoles clear visible, the student will be able to identify each.

3. Variety & Pattern (Animals)-Interpreting Data

   Given insects or pictures of insects, the student will be able to classify the coloration as aggressive/protective or warning. (praying mantis, grasshopper, dragonfly, brown moth, butterfly, walking stick, bumble bee, yellow jacket, wasp, etc.)

4. Variety & Pattern (Animals)-Classifying

   Given drawings of two unknown "bugs", the student will be able to classify and identify the insect based upon a known physical characteristic. (3 body segments, wings, etc.)

5. Variety & Pattern (Animals)-No Process

   When asked to describe the skeleton of an insect, the student will be able to recall that the body covering of an insect is its skeleton.

6. Variety & Pattern (Microbes)-Interpreting Data

   Given a graph to show the temperature range in which molds grow and the ranges which spores can survive, the student will be able to generate a verbal interpretation which must include that no molds grow below 20°F or above 140°F, but that spores may survive temperatures from -20°F to 220°F by stating their interpretation of the graph.

7. Survival & Adaptation-Interpreting Data

   Given a drawing of the web of life and the concept that all living things depend on conditions in their surroundings, the student will be able to apply the web of life concept by stating how the web functions in a new environment. (Must include that all the life in the environment depends upon energy from the sun for food and that each organism depends upon others in the environment.)

GRADE SIX OBJECTIVES

6:8-13

BIOLOGICAL SCIENCES

8. Survival & Adaptation-Inferring

Given a description of a dominant trait such as brown eyes, tall bean plants, red flowered pea plants, tasters of PTC, etc., and asked to describe the possible genotype of the parents, the student will be able to apply the concept of Mendelian dominance by stating that the parents could be DD-DD; DD-DR; DD-RR; DR-DD; DR-DR; DR-RR; RR-DD; or RR-DR, where D = dominant and R = recessive.

9. Survival & Adaptation-Identifying Variables

Given the genotype of two parents whose genes are unlike, heterozygous, trait such as the Rh blood factor, tallness in bean plants, blood type, etc., and asked to state the possible genotypes that may be a result of the union of these two individuals, the student will be able to apply the concept of simple Mendelian inheritance by listing the genotypes of the offspring of the union.

10. Interaction & Interdependence-Inferring

Given a graph that shows the relationship in the size of two populations of a predator and a prey ending in abnormal populations for three of the seven to ten units of time, the student will be able to state and test his inference.

11. Interaction & Interdependence-Inferring

The student will be able to develop a report containing the dominant animals and plants and present it to the class including his/her reasons for his/her interest in the particular community.

12. Continuity & Change-Formulating Hypotheses

Given a description of a spaceship as a closed system with finite resources (atmosphere, food, industrial raw material, and energy) and told that Earth is like a spaceship and asked what procedures Earth's passengers must implement in order to insure a safe journey, the student will be able to originate 3 procedures which he/she considers important to the survival of Earthlings by listing three such as conservation of resources, new energy sources, etc.

13. Continuity & Change-Inferring

Given a statement that permanent damage occurs to the retina when exposed to ultra-violet light rays and a description of the types of light rays found in sunlight, the student will be able to infer the possible effect of observing a solar eclipse.

GRADE SIX OBJECTIVES

PHYSICAL SCIENCES

6:14-19

14. Matter-Identifying Variables

Given a demonstration of the swing of a pendulum (a rubber ball, a piece of string, and a hand) and directed to observe the time it takes the ball to swing back and forth, the student will be able to identify from among a list of variables that when changed might speed up or slow down the swing of the pendulum. (Weight of the ball, length of the string, strength of the person, color of the ball, smoothness of the string, strength of the initial push of the ball, etc.)

15. Matter-Defining Operationally

Given a demonstration illustrating properties of two gases (one of which is oxygen) and told the names of each gas, the student will be able to operationally define oxygen.

16. Matter-Classifying

Given a demonstration in which heat is applied to a saturated solution, the student will be able to state that heat increases the saturation point of the solution.

17. Matter-No Process

The student will be able to recall that when matter changes states from a solid to a liquid to a gas, molecules spread farther apart and move with more freedom.

18. Matter-Classifying

Given diagrams of molecules representing the three states of matter, the student will be able to identify the molecules by labeling them as either a solid, liquid, or gas.

19. Matter-Classifying

Given several labeled solids (e.g., baking soda, baking powder, cornstarch, powdered chalk, powdered sugar, talcum powder) and given a supply of water, vinegar, and iodine solution and containers and stirrers and directed to test the solids as to their interaction with the liquids, the student will be able to classify each solid according to a given experimental design. (soluble in water, foams in vinegar, foams in water; soluble in water, foams in vinegar, does not foam in water; not soluble in water; does not foam in vinegar, turns blue-black in iodine solution; etc.)

GRADE SIX OBJECTIVES
PHYSICAL SCIENCES

20. Matter-No Process

Given a list of the following materials: a beaker of sand, a graduated cylinder, and a water supply, the student will be able to generate a procedure to determine the volume of air space in the sand. (1. pour some sand into cylinder-record the volume of air space in the sand, 2. pour measured amount of sand into empty beaker, 3. pour some water into cylinder and measure volume, 4. add measured sand and record volume of sand and water, 5. subtract volume in #3 from #4, 6. Subtract #5 from #1)

21. Energy & Force-Interpreting Data

Given a hypothesis that the closer together molecules are, the faster sound will travel; and given a set of drawings of the molecular structure of the three states of matter; the student will be able to generate a prediction that sound will travel faster in a solid than in a liquid or a gas.

22. Energy & Force-Predicting

Given a set of statements about the properties of sound, the student will be able to discriminate among the statements by marking the statements which are true.

23. Energy & Force-Identifying Variables

Given a demonstration of vibrating a string or rubber band to produce a sound and asked to name three ways the pitch (frequency) of the vibrating string or band can be controlled, the student will be able to identify the controlling variables by stating that the length of the strings, the tension on the strings, and the thickness of the string are the controlling variables of pitch of a vibrating string.

24. Energy & Force-Measuring

Given three questions about the force required to move a load using a lever, pulley, and wheel and axle system, the student will be able to apply the mathematical relationships in each system by computing the number of pounds of force required in each system.

25. Energy & Force-Interpreting Data

Given a work situation, the student will be able to compute the amount of work accomplished by multiplying the amount of force exerted by the distance the object moves.

GRADE SIX OBJECTIVES
PHYSICAL SCIENCES

6:26-29

26. Energy & Force-Measuring

Given materials to measure the difference in forces required to lift an object vertically and through an inclined plane, the student will be able to manipulate the materials to show that the force exerted through the inclined plane is less than the vertical force required to lift the object.

27. Matter-Energy Changes-Inferring

Given a demonstration of applying a horizontal force on an object without setting it in motion and another application of force in the same direction on the same object setting it in motion, the student will be able to generate an inference that the first force was insufficient to overcome the frictional force.

28. Interaction with Man-Inferring

Given a hypothetical case of individuals sharing equally an energy supply, the student will be able to generate a solution to meet an additional demand such that the new individual shares an equal amount of energy with the old individuals.

29. Interaction with Man-No Process

Given a list of 5 energy sources (e.g., wood, coal, nuclear, electrical, petroleum) that man uses and asked to order the sources by their historical development, the student will be able to arrange the sources by listing them in the following order: wood, coal, petroleum, electrical, and nuclear.

GRADE SIX OBJECTIVES
EARTH-SPACE SCIENCES

30. Earth-Communicating

The student will be able to name and describe three theories that have been developed to explain the formation of the solar system.

31. Earth-Communicating

Given two aquariums of widely different sizes with prepared water in each and four healthy medium sized gold fish in each, the student will be able to observe and record different reactions to the two environments by keeping daily observations in notebooks over a period of one month. (Observations will include such variables as plant life, food, snails, pH of water.)

32. Earth-Inferring

Given a diagram of an igneous intrusion forming a sill in a limestone formation and asked what he/she thinks will happen to the limestone immediately surrounding the intrusion, the student will be able to state that the surrounding limestone will be affected by the heat and will be changed or metamorphised into the metamorphic rock marble.

33. Earth-Inferring

Given the diagram of folded sedimentary rocks and asked what direction the applied force came from, the student will be able to demonstrate the concept that forces to compress sediments into folds were from the sides and are from the direction of the area of the most folds by drawing an arrow to indicate the force direction.

34. Earth-Measuring

Given a thermometer, the student will be able to measure the soil or sand surface temperature, 15 cm below the surface, 30 cm below the surface, and 45 cm below the surface and display his/her data on a graph.

35. Earth-Experimenting

Given a set of four rocks (e.g., obsidian, limestone, sandstone, slate) and asked to determine which is the hardest rock, the student will be able to design an experiment and state evidence of hardness when asked.

GRADE SIX OBJECTIVES
EARTH-SPACE SCIENCES

6:36-40

36. Earth-Formulating Hypotheses

Given each of the four factors that have caused the present ecological crisis situation on earth (imbalance between birth and death rates, GNP based on obsolescence and waste, finite nature of earth and its mineralized crust, increased risk of irreversible spoilation of environment), the student will be able to propose permanent long-range solutions for each factor.

37. Earth-Formulating Hypotheses

Given a chart showing fuel reserve lifetimes for coal, crude oil, natural oil, and uranium 235, the student will be able to predict some possible consequences in the world in the year 2000 based on information given.

38. Water-Classifying

Given a cross section showing the edge of a continent and ocean, the student will be able to identify continent, continental slope, continental shelf, abyssal plain, and mid-oceanic ridge.

39. Water-Using Space/Time Relationships

Given data on the temperature of different layers of the ocean, the student will be able to place the layers in their relative positions by applying the rule that a liquid will sink below any other liquid that is less dense. (12°C, 21°C, 5°C, etc.)

40. Water-Experimenting

Given an hypothesis that marine fish breeding is affected by the salinity of the water, the student will be able to design an experiment to test the hypothesis. (Variables must include manipulating, responding, and controlling.) (Design should include (1) variables, (2) procedures to be followed, (3) equipment to be used, (4) data to be collected.) (Consider temperature, volume of tanks, surface area of tanks, food, oxygen content, etc.)

GRADE SIX OBJECTIVES
EARTH-SPACE SCIENCES

41. Air-Interpreting Data

Given diagrams of an aquarium tank, a light source, some soil, ice, and a smoke source and asked to state why the smoke moves as it does, the student will be able to apply the concept of convection by making a statement to the effect that the smoke follows the paths of the air and rises over the warmer soil and sinks over the ice since warm air is less dense than cool air.

42. Air-Classifying

Given a list of conditions relative to the earth-atmosphere system, the student will be able to apply the concept of the greenhouse effect by selecting the condition which best characterizes this phenomena. (The sunlight or sun radiation changes to heat or heat radiation when it strikes the earth's surface which in turn warms the atmosphere. Heat radiation is trapped in the atmosphere.)

43. Air-No Process

Given two definitions, one of humidity and one of relative humidity, the student will be able to match each concept to its definition. (humidity-the amount of water vapor the air is actually holding, relative humidity-the ratio expressed generally as a percentage of the amount of water vapor that the air is holding compared to the maximum amount of water vapor that the air can hold under the same conditions)

44. Air-Predicting

Given a graph of prevailing wind direction and pressure on sequential days during the year, the student will be able to predict the approximate prevailing wind direction for a specified pressure.

45. Air-Inferring

Given a diagram showing a sail boat offshore at 4:00 p. m. and asked to determine in which direction to sail to attain maximum speed, the student will be able to apply the concept of the sea breeze and indicate the proper direction of the ship. (The maximum speed would be attained by sailing directly toward the shore.)

46. Space-Measuring

Given a map of a section of the moon and a scale for the map, the student will be able to apply scale concepts to determine the width of a crater. (State the answer in kilometers.)

GRADE SIX OBJECTIVES
EARTH-SPACE SCIENCES

6:47-52

47. Space-No Process

Given a list of six to eight survival items and told that he/she has crash landed on the moon and is to use a list of items to reach a rendezvous point 200 miles away and asked to rank the items in terms of their importance and to explain the order, the student will be able to choose the order of the items and state reasons for his/her list. (The ranking is irrelevant, but the reasons should be consistent with his/her choices.) (50 feet nylon rope, 45 calibre pistol, star map, 5 gallons of water, box matches, two 100-pound tanks of oxygen, food concentrate, life raft, parachute silk, magnetic compass, signal flares, portable heating unit, one case dehydrated milk)

48. Space-Predicting

Given two samples of a dark colored igneous rock (gabbro or basalt), one showing discoloration, the student will be able to select the weathered rock as the one that could not have been collected on the moon and state that the weathering processes do not occur on the moon.

49. Space-Inferring

Given a list of inference statements, the student will be able to select the inference that the Moon has no atmosphere because the low gravitational field of the Moon prevented the retention of gases.

50. Space-Interpreting Data

Given a map of the moon with features labeled, the student will be able to order the labeled moon features according to age.

51. Space-No Process

Given a diagram (or pictures) showing the crescent, gibbous, quarter, and full phases of the moon and asked to select the diagram depicting each of the phases, the student will be able to recall the phases by matching the name of the phase with its illustration.

52. Space-Measuring

Given a diagram of a circle that represents the size of the sun, a metric ruler, and a scale factor of Earth and Sun, the student will be able to determine how large a circle should be to represent Earth.

53. Space-Interpreting Data

Given surface gravity data of several planets relative to Earth and told the weight of an astronaut and asked to determine the astronaut's weight on each planet, the student will be able to apply the concept that weight on another planet is the product of earth weight times surface gravity relative to earth by calculating the weight of the astronaut on each planet. (suggested astronaut weight-200 pounds)

54. Space-Interpreting Data

Given the fact that the closest star, Proxima Centauri, is about 40 trillion kilometers away or more than 100 million times farther than the moon or 4.3 light years, and the supposition that rockets could be made to travel about 10 times faster than present (to about 300,000 km/hr), and asked how long it would take to get to Proxima Centauri, and could this journey be made in one lifetime (light travels 300,000 km/sec), the student will be able to state that it would not be possible in one lifetime.

55. Space-Inferring

Given that some stars seen in winter cannot be seen during the summer, the student will be able to apply the concept of "revolution of the earth" and tilt of the axis of rotation of the earth in explaining this phenomenon.

56. Space-Inferring

Given a series of dated diagrams showing the earthly horizon with a setting sun at various positions on this horizon, the student will be able to apply the concepts of revolution and the tilt of the axis of rotation in explaining the varying setting sun positions. (Since the earth is tilted on its axis, different points on the earth are perpendicular to the sun's rays as the earth revolves around the sun and, therefore, the sun will set at different points on the horizon.)

57. Space-Inferring

The student will be able to apply the concept of rotation of the earth to explain the apparent east - west motion of the stars in the sky.

GRADE SIX OBJECTIVES
EARTH-SPACE SCIENCES

58. Space-No Process

Given the choice of traveling to the moon for the collection of rocks or developing instrumentation which could provide the same function, and assuming the role of a geologist, the student will be able to choose to go to the moon or to develop instrumentation and state his/her reasons why. (The choice is irrelevant, but the reason for the choice should be logical.)

59. Space-No Process

Given a list of rationales for manned space flight projects undertaken by the United States and asked to select the one rationale which seems most relevant to the society of today, the student will be able to choose a rationale and state why. (The choice is irrelevant, but the reason for the choice should be logical.) (Rationales: Man can think better in space since he has a different perspective on earth. Men can see many things cameras can't. Physiological studies can best be done on man rather than monkeys. Men may be required to fix broken equipment.)

60. Space-No Process

When asked to state some current benefits of space research in medicine, the student will be able to respond to the effect that current benefits of space research in medicine have resulted in improved medical techniques, diagnosis, and treatment systems. (electronic pacemaker, radio-linked automatic patient monitoring system, diagnosis of respiratory diseases using non-invasive physiological measuring technique, sprayed on electrodes for electrocardiogram, portable volume-controlled respirator, muscle accelerometer-measures minute muscular tremors, sight switch-activated by a mere movement of the eye, sound converter-converts audio sound to vibrations-used by deaf people to 'hear' through fingertips)

LEVEL: GRADE SIX

CONTENT: Biological Sciences

Variety & Pattern (Animals)

PROCESS: Classifying

6:4

OBSERVING INSECTS

(Page 1 of 3)

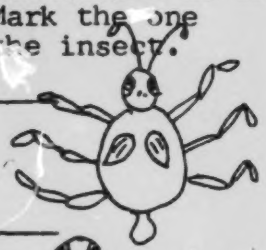
OBJECTIVE #4

Given drawings of two unknown "bugs", the student will be able to classify and identify the insect based upon a known physical characteristic. (3 body segments, wings, etc.)

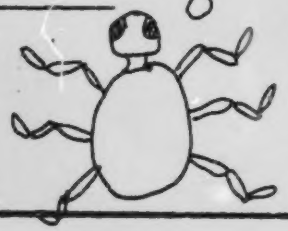
ASSESSMENT #4

Below are two drawings of strange bugs. One of them could be identified as an insect. Mark the one which is the insect.

A.____________



B.____________



RELATED ACTIVITY

Teacher Information:

Students are given an opportunity to participate in making a cage and caring for insects. They can also watch various developmental changes and insect characteristics which can be used as the basis for classroom discussions.

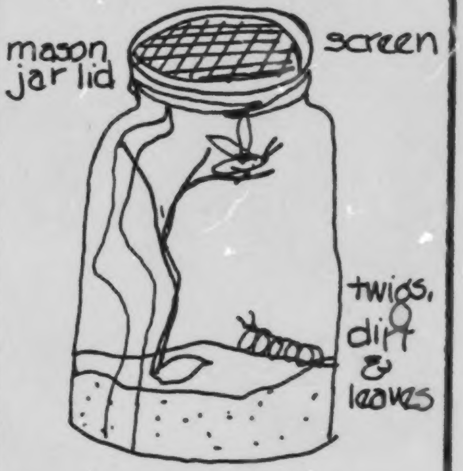
The cage described here is easily kept clean and adapted for use with various insects. The all-around view provides a clear observation of the insect. The size of the jar can be varied according to the need.

Procedure:

1. Cut screen to fit jar lid; it replaces the center of the lid.
2. Place soil, leaves, twigs, and insect inside of the jar and replace screen lid. Fasten securely.
3. Determine what conditions are necessary in order to keep the insect alive.
4. Test to determine the insect's preferred food.

MATERIALS

- screen 3" x 3"
- wide mouth jar and open lid
- caterpillar or other insect
- a small amount of soil, leaves, and small twigs



LEVEL: GRADE SIX
CONTENT: Biological Sciences
Variety & Pattern (Animals)
PROCESS: Classifying

6:4

COLLECTING INSECTS

(Page 2 of 3)

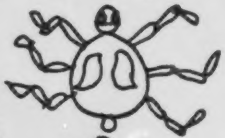
OBJECTIVE #4

Given drawings of two unknown "bugs", the student will be able to classify and identify the insect based upon a known physical characteristic. (3 body segments, wings, etc.)

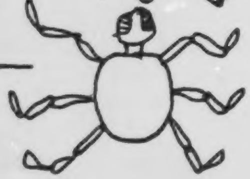
ASSESSMENT #4

Below are two drawings of strange bugs. One of them could be identified as an insect. Mark the one which is the insect.

A.__________



B.__________



RELATED ACTIVITY

Procedure:

1. Insects must be mounted on insect pins.
2. Place older specimens in a "relaxing jar," a wide-mouth jar with wet sand on the bottom. Add to this a few drops of formalin and place the insects in the jar on the sand or on a small dish and close the jar tightly. The specimens will be soft enough to handle in a few days.
3. Hold the specimen between the fingers of one hand while putting the pin in vertically with the other hand. Push the specimen up toward the head of the pin with the fingers. Use forceps for pushing the insects upon the pin.
4. Put the pin through the center of the stoutest part of the body, but never through a joint that lies between two parts of the insect.
5. Beetles must be pinned through on one of the hard shell wings, just to the right of the mid-line down through which the two wings meet on the body.
6. True bugs will need to be pinned through the small triangular piece that is attached to the hind end of the thorax.
7. Keep specimen in most natural position. Place those with slender abdomens low on the pin.

MATERIALS

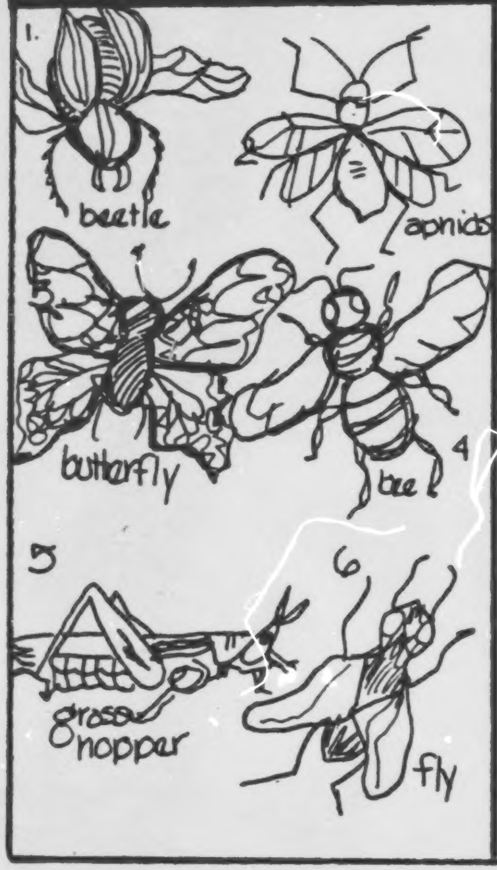
insects collected on a field trip
insect pins (size 2 or 3)
forceps
cardboard insect boxes
glue
white card stock
marker, cardboard

LEVEL: GRADE SIX
CONTENT: Biological Sciences
Variety & Pattern (Animals)
PROCESS: Classifying

6:4

CLASSIFYING INSECTS

(Page 3 of 3)



RELATED ACTIVITY

After identifying the common characteristics of insects, more advanced students may choose to study the common insect orders.

Table of the more common insect orders:

1. Coleoptera-sheath wings: Beetles
   Two pairs wings; outer-hard covering membranous hind wings, complete metamorphosis, biting mouthparts
2. Hemiptera-half or no wings: Bugs aphids, and scale insects
   Three types:
   Forewings thickened at base, thin ends overlap
   Forewings thickened throughout, roof-shaped over back
   No wings at all
3. Lepidoptera-scale wings: Butterflies and moths
   Two pairs wings, often showy, covered with scales (spicules)
   Complete metamorphosis, adult mouth parts for sucking
4. Hymenoptera-membrane wings: Bees wasps, ants, etc.
   Two pairs wings, membranous wings, sometimes hooked together
   Metamorphosis complete, mouth parts biting, sometimes modified
5. Orthoptera-straight wings: Grasshoppers, crickets, etc.
   Two pairs wings, outer straight over back, somewhat thickened
   Hind wings for flight, folded under forewings, metamorphosis incomplete, mouth parts biting
6. Diptera-two wings:
   True flies, flies, mosquitoes, midages
   One pair membranous wings, complete metamorphosis
   Mouth part biting or sucking

LEVEL: GRADE SIX

CONTENT: Biological Sciences
Interaction & Interdependence

PROCESS: Inferring

6:10

DESCRIBING PREDATOR-PREY RELATIONSHIPS *
(Page 1 of 2)

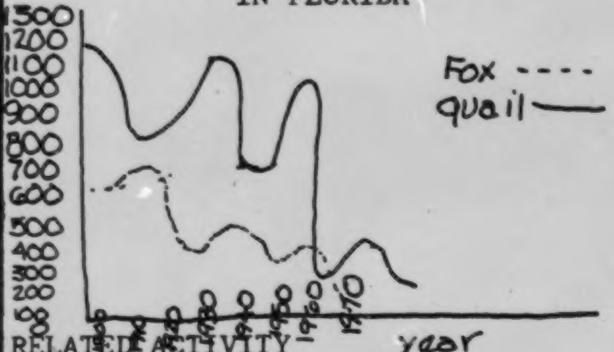
OBJECTIVE #10

Given a graph that shows the relationship in the size of two populations of a predator and a prey ending in abnormal populations for three of the seven to ten units of time the student will be able to originate and test an inference.

ASSESSMENT #10

A pattern of predator-prey populations usually follows a pattern of gradual rise and fall as is shown in the graph below. The fox is the predator and the quail is the prey. In the late 1950's and throughout the 1960's both populations decreased in number. Tell what might have happened to cause this decrease in population and what you would do to find out if you were right.

FOX AND QUAIL IN COUNTY X IN FLORIDA



RELATED ACTIVITY

Procedure:

1. Provide students with a picture of an Everglades Park scene. (See sketch under "Materials".)
2. Record on the board the pertinent vocabulary as needed by students. (scavengers, decomposers, balance of nature, web of life, predator-prey relationship, predator chain, parasite chain, saprophyte chain, carnivorous animals, pollutant, etc.)
3. Ask students to describe the picture.
4. Ask students to find any two figures that relate to each other in some way, such as a frog and a dragonfly. (Accept answers that indicate such relationships as living-nonliving (rock and tree), animal-plant (grasshopper and leaf), etc. but attempt to elicit the response that one animal eats the other for food (the predator prey relationship).

*Dade County Public Schools, Ecology in the Elementary School (Miami, Fla.: Dade County Public Schools Textbook Department, 1970), pp. 4-5.

LEVEL: GRADE SIX

CONTENT: Biological Sciences

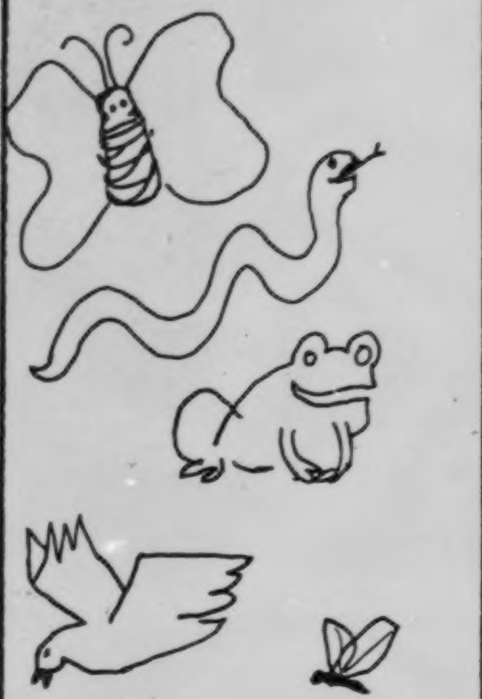
Interaction & Interdependence

PROCESS: Inferring

6:10

DESCRIBING PREDATOR-PREY RELATIONSHIPS

(Page 2 of 2)

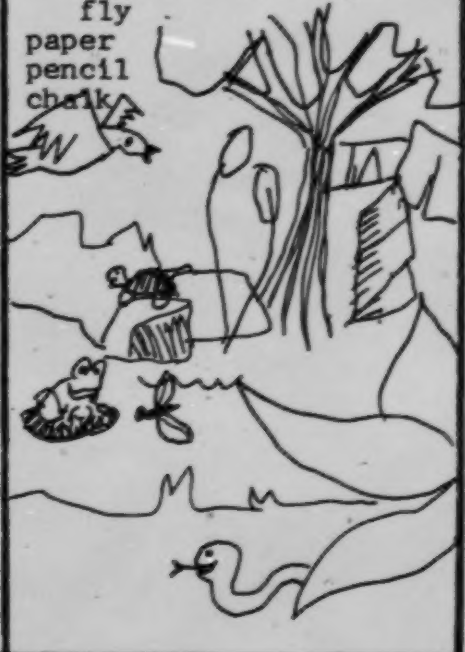


RELATED ACTIVITY

5. Ask which vocabulary words tell about the predator-prey relationship.
6. Ask students to list all of the predator-prey relationships they can identify and describe in a short sentence which figure feeds upon the other.
7. Provide students with pictures of five creatures in random order: frog, hawk, butterfly, snake, dragonfly.
8. Ask students to place these creatures in a diagram that will show how each fits within a single food chain. (Students should construct a food chain that graphically represents the interactions of predators in nature.)

MATERIALS

picture of Everglades Park scene
individual pictures of a frog, hawk, butterfly, snake, dragonfly
paper
pencil
chalk



LEVEL: GRADE SIX

CONTENT: Biological Sciences
Continuity & Change

PROCESS: Formulating Hypotheses

6:12

CONSERVING WATER*

(Page 1 of 2)

OBJECTIVE #12

Given a description of a spaceship as a closed system with finite resources (atmosphere, food, industrial raw material, and energy) and told that Earth is like a spaceship and asked what procedures Earth's passengers must implement in order to insure a safe journey, the student will be able to originate 3 procedures which he/she considers important to the survival of Earthlings by listing 3 such as conservation of resources, new energy sources, etc.

ASSESSMENT #12

When the astronauts go into outer space, everything which enables them to survive must be included such as atmosphere, food, and energy. Earth is like a spaceship because everything which is needed for survival has been included. Recently man has almost used up some of these items. Briefly list 3 ways which are important so that man can ensure a long safe journey on spaceship Earth.

RELATED ACTIVITY

Teacher Information:

Students will construct a model illustrating the moisture-holding quality of various soils and will relate these activities to methods farmers can use to conserve water in soil.

In an attempt to conserve water in soil, the farmer can try to slow the rate at which water soaks through the soil. Allowing a field to stand unplanted for a year or planting clover are two methods by which farmers help the natural buildup of humus. Some soils, rich in humus, tend to retard the runoff of water by letting it slowly seep through soil, thus nourishing the plants as well as preventing floods.

Procedure:

1. Punch 5 holes in the bottoms of each of 3 cans. Fill one can with sand, another with gravel, and the third with humus (dry vegetative matter, leaves, etc.).
2. Place the three cans on a piece of suspended screening so that each can is about two inches directly above a glass beaker.
3. Pour equal amounts of water into the three cans. After several

*Dade County Public Schools, Ecology in the Elementary School (Miami, Fla.: Dade County Public Schools Textbook Department, 1970), pp. 65-66.

LEVEL: GRADE SIX

CONTENT: Biological Sciences

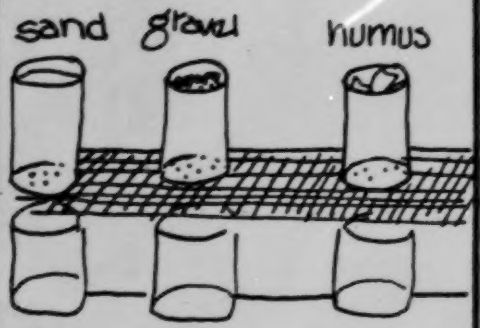
Continuity & Change

PROCESS: Formulating Hypotheses

6:12

CONSERVING WATER

(Page 2 of 2)



RELATED ACTIVITY

minutes, compare the amount of water that has dripped through to each of the beakers.

Questions:

1. What differences are observed?
2. What could be concluded from this experiment about the different kinds of soil?
3. How would these conclusions affect the farmer?
4. How would these conclusions affect the conservation of resources on Earth?

MATERIALS

for each group of 4 to 5 students:
- 3 small juice cans
- 3 glass beakers
- hammer and nail for punching 5 holes in bottoms of each can
- sand
- gravel
- humus (dry vegetative matter, leaves, etc.)
- screening
- two stacks of books for suspending screening
- water

LEVEL: GRADE SIX

CONTENT: Physical Sciences
Matter

PROCESS: Defining Operationally

6:15

TESTING FOR OXYGEN

OBJECTIVE #15

Given a demonstration illustrating properties of two gases (one of which is oxygen) and told the names of each gas, the student will be able to operationally define oxygen.

ASSESSMENT #15

You have seen me place a glowing splint into each of these labeled containers. Use this demonstration to write an operational definition of oxygen.

RELATED ACTIVITY

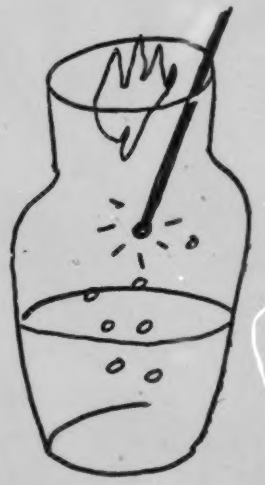
Teacher Information:
Liquid oxygen (LOX) is a frequently used oxidizer used with kerosene in launch vehicles. The gas which is formed in this activity is not liquid oxygen but the gas into which liquid oxygen would change.

Procedure:

1. Pour about one inch of hydrogen peroxide in a small bottle and add a teaspoon of ordinary baking soda.
2. Place a piece of cardboard over the top and set it aside for about five minutes. (The tiny bubbles that escape from the peroxide are bubbles of oxygen gas.)
3. Light a broom straw or long wooden splinter. Blow out the flame.
4. Put the glowing straw into the gas and notice how the oxygen increases the action. (It should burst into flames.)
5. Describe the results. Define the operation of the gas.

MATERIALS

- hydrogen peroxide
- baking soda
- teaspoon
- small bottle
- piece of cardboard
- match
- broom straw or long wooden splinter



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LEVEL: GRADE SIX

CONTENT: Physical Sciences

Matter

PROCESS: Defining Operationally

6:15

DESCRIBING THE OPERATION OF A FIRE EXTINGUISHER

OBJECTIVE #15

Given a demonstration illustrating properties of two gases (one of which is oxygen) and told the names of each gas, the student will be able to operationally define oxygen.

ASSESSMENT #15

You have seen me place a glowing splint into each of these labeled containers. Use this demonstration to write an operational definition of oxygen.

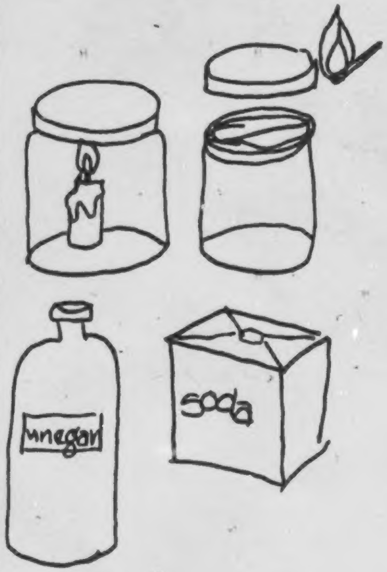
RELATED ACTIVITY

Procedure:

1. Place a candle in a jar, light candle, and let burn for several minutes.
2. Close this jar with lid.
3. Place a lighted match in a jar containing soda and in a jar containing vinegar, observing that the match is not yet extinguished.
4. Insert lighted match into jar containing a mixture of soda and vinegar. Observe that the match is immediately extinguished.
5. Demonstrate that carbon dioxide is heavier than air by pouring it from one jar into another. Provide students with the opportunity to generate the procedures for this activity.
6. Describe the results.

MATERIALS

3 jars with lids
matches
vinegar
candle
sodium bicarbonate



6:15

LEVEL: GRADE SIX

CONTENT: Physical Sciences

Matter

PROCESS: Defining Operationally

PRODUCING CARBON DIOXIDE

OBJECTIVE #15

Given a demonstration illustrating properties of two gases (one of which is oxygen) and told the names of each gas, the student will be able to operationally define oxygen.

ASSESSMENT #15

You have seen me place a glowing splint into each of these labeled containers. Use this demonstration to write an operational definition of oxygen.

RELATED ACTIVITY

Teacher Information:

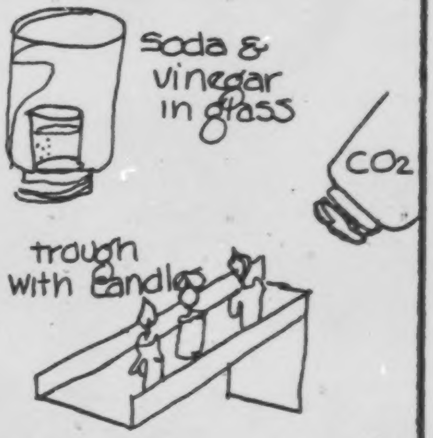
Mixing vinegar and soda produces carbon dioxide. In this activity, carbon dioxide gas fills a jar. Carbon dioxide is heavier than air and, thus, can be "poured" from the bottle. Carbon dioxide puts out fire by cutting off the oxygen supply and smothering it.

Procedure:

1. Attach candles to bottom of a trough.
2. Use a prop to tilt one end.
3. Light candles.
4. Place handful of baking soda in glass.
5. Add a half cup of vinegar.
6. Place jar over the glass.
7. After bubbling subsides a little, take off jar and "pour" carbon dioxide gas out of jar and down trough.
8. Discuss why the carbon dioxide floats down the trough instead of rising.
9. Discuss the relationship of this activity to fire control.

MATERIALS

- large glass jar
- baking soda
- vinegar
- 3 candles
- wood or cardboard trough
- small drinking glass
- match



LEVEL: GRADE SIX

CONTENT: Physical Sciences

Energy & Force

PROCESS: Interpreting Data

6:21

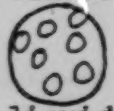
DESCRIBING HOW SOUND TRAVELS

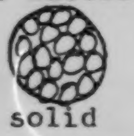
OBJECTIVE #21

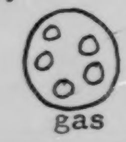
Given a hypothesis that the closer together molecules are, the faster sound will travel; and given a set of drawings of the molecular structure of the three states of matter; the student will be able to generate a prediction that sound will travel faster in a solid than in a liquid or a gas.

ASSESSMENT #21

Here is a hypothesis: the closer together molecules are the faster sound will travel. Using these drawings of the molecules of a solid, a liquid, and a gas, tell me in which state of matter sound will travel the fastest.


liquid


solid


gas

RELATED ACTIVITY

Teacher Information:

Students will determine the form of matter through which sound travels best.

Procedure:

1. Ask students to alternately cap their hands in front of their ears and in back of their ears to determine the way that helps a person to hear sound better. (Sound travels through the air to reach the ears.)
2. Fill a large pail or other container with water. Hold two rocks down in the water and strike them together hard. Ask a student to put his/her ear near the water. (Sound travels through liquids.)
3. Ask a student to put his/her ear close to the end of a wooden table. Hit the wood with a pencil. (Sound travels through solids.) Which form of matter carried sound the best?
4. Explore what steps the community is taking to reduce noise pollution.
5. Make a chart of the thunderstorms in the community. Include the date, time, and location of each observation and the time that elapsed between seeing the lightning and hearing the thunder.

MATERIALS

large pail
water
two rocks
wooden table
pencil
chart paper
marker

6:22

LEVEL: GRADE SIX
CONTENT: Physical Sciences
Energy & Force
PROCESS: Predicting

SEEING SOUND WAVES

OBJECTIVE #22
Given a set of statements about the properties of sound, the student will be able to discriminate among the statements by marking the statements which are true.

ASSESSMENT #22
Here is a list of statements about the properties of sound. Put an X only by the statements you think are true.

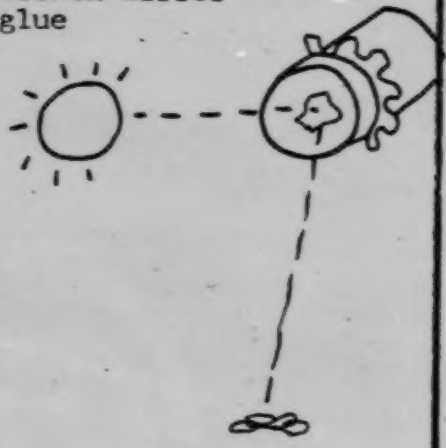
___a. Sound can travel in a vacuum.
___b. Sounds are loudest near the source.
___c. Sound can travel faster than light can travel.
___d. Not all vibrating objects make a sound
___e. Sound travels in all directions from its source.

(Ans.: b, d, e)

RELATED ACTIVITY
Teacher Information:
Students will make an oscilloscope. By the use of this instrument, each sound will make a different pattern on a wall.

Procedure:
1. Take the top and bottom off of a tin can.
2. Stretch a piece of rubber from a balloon over one end of the tin can. Secure the balloon with rubber bands.
3. Glue a one-fourth piece of a broken mirror to the balloon, just off center.
4. Stand near a window so the sun will reflect from the mirror onto a wall as a bright spot. Make different sounds into the open end of the tin can.
5. Describe the results.

MATERIALS
tin can with top and bottom removed
balloon
rubber bands
broken mirror
glue



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LEVEL: GRADE SIX

CONTENT: Physical Sciences

Energy & Force

PROCESS: Identifying Variables

6:23

CHANGING PITCHES USING RUBBER BANDS

OBJECTIVE #23

Given a demonstration of vibrating a string or rubber band to produce a sound and asked to name three ways the pitch (frequency) of the vibrating string or band can be controlled, the student will be able to identify the controlling variables by stating that the length of the strings, the tension on the strings, and the thickness of the strings are the controlling variable of pitch of a vibrating string.

ASSESSMENT #23

You have watched me make a sound by vibrating this string. Name three ways the pitch or frequency of a vibrating string can be controlled.

RELATED ACTIVITY

Procedure:

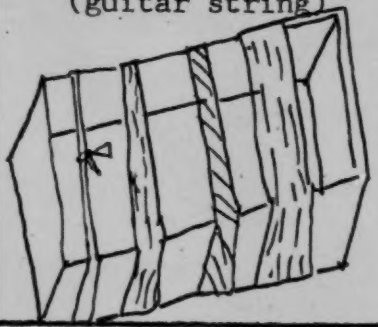
1. Place bands of the same thickness but different lengths around a box and pluck each band.
2. Using only one band, place on the box and pluck. Tighten band and pluck again.
3. Place bands of same lengths but different widths on box and pluck each band.
4. Describe the results. (Short bands will have a higher pitch than long bands. Tight bands will have a higher pitch than loose bands. Thin bands will have a higher pitch than thick bands. Light materials will have a higher pitch than heavy materials.)
5. Observe the results closely. (Students will observe that high pitches result from many vibrations and low pitches result from few vibrations.)
6. Utilizing other materials, follow the procedures above.

Questions:

1. Why won't a heavy band vibrate as rapidly as a light band?
2. Why will stretching a rubber band or a piece of cat gut cause it to vibrate faster?

MATERIALS

wooden box open at top
rubber bands of varied lengths and thicknesses
string
wire
piece of cat gut (guitar string)



LEVEL: GRADE SIX

CONTENT: Physical Sciences
Energy & Force

PROCESS: Identifying Variables

6:23

REGULATING THE PITCH OF VIBRATING STRINGS

(Page 1 of 2)

OBJECTIVE #23

Given a demonstration of vibrating a string or rubber band to produce a sound and asked to name three ways the pitch (frequency) of the vibrating string or band can be controlled, the student will be able to identify the controlling variables by stating that the length of the strings, the tension on the strings, and the thickness of the strings are the controlling variables of pitch of a vibrating string.

ASSESSMENT #23

You have watched me make a sound by vibrating this string. Name three ways the pitch or frequency of a vibrating string can be controlled.

RELATED ACTIVITY

Teacher Information:

Four different characteristics regulate the pitch of vibrating strings:

1. The tension - The higher the tension the higher the pitch. (Same thickness & length & materials)
2. The thickness - The thinner the wire the higher the pitch. (Same material, same length & tension)
3. The material - The lighter the material the higher the pitch. (Same length, tension, & thickness)
4. The length - The shorter the wire the higher the pitch. (Same material, thickness, & tension)

Procedure:

1. Arrange four wires on a frame like the one in the sketch. A and B are made of steel of the same length and thickness. A has a two pound weight on it, B has a three pound weight. When the wire is stretched, we say it has tension. C is also made of steel wire but is not as thick as A or B. D is made of copper wire which is lighter than steel wire.
2. Pluck the various wires and note the differences in pitch produced.
3. Press a wire firmly to the table with your finger and pluck it again.
4. Note the difference in pitch. Repeat with the other wires.

Questions:

1. What does this activity have to do with tuning a piano?
2. What does this activity have to do with the selection of guitar strings?

LEVEL: GRADE SIX

CONTENT: Physical Sciences

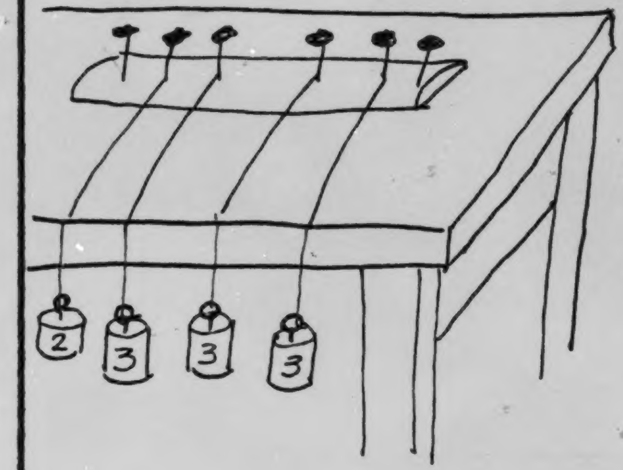
Energy & Force

PROCESS: Identifying Variables

6:23

REGULATING THE PITCH OF VIBRATING STRINGS

(Page 2 of 2)



MATERIALS

2 steel wires, same thickness

1 steel wire, thinner than above

1 copper wire, same thickness as single steel wire

frame as illustrated in sketch

1 two pound weight

3 three pound weights

table

300

LEVEL: GRADE SIX

CONTENT: Earth-Space Sciences

Space

PROCESS: Inferring

6:57

OBSERVING THE STARS IN THE NIGHT SKY

OBJECTIVE #57

The student will be able to apply the concept of rotation of the earth to explain the apparent east-west motion of the stars in the sky.

ASSESSMENT #57

When one observes the night sky, the stars seem to move from east to west. Why do the stars have this motion?

(Since the earth rotates on its axis from west to east, the stars appear to move from east to west since they are at such great distances that motion is not apparent.)

RELATED ACTIVITY

Teacher Information:

The rotation of the earth on its axis causes the illusion of constellations moving in the sky. Students in the northern hemisphere will observe that the constellations seem to be revolving counterclockwise as they look up around the North Star (Polaris).

Procedure:

1. Fasten paper stars inside an umbrella to represent certain constellations.
2. Twist 3 pipe cleaners into the shape of a human figure.
3. Secure the figure on a globe with tape.
4. Hold the unbrella so the handle forms a straight line extension to the center of the globe.
5. Rotate the globe while holding the unbrella stationary.
6. Have students walk around the globe as it rotates, maintaining the position of the pipe cleaner figure.

Questions:

1. How would the stars appear to move if you lived in the southern hemisphere?
2. How could we tell our longitudinal position by the stars?

MATERIALS

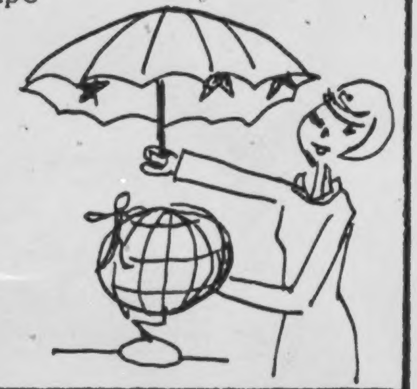
globe or round ball to represent the earth

unbrella

paper stars

3 pipe cleaners

tape



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GRADE SIX RELATED MATERIALS 6:1-6						
OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
1. Identifying manipulated and responding variables in plant water loss.		6:41	Pt. 6: 165-172 185-199			
2. Identifying cell membrane, cytoplasm, nuclear membrane, nucleus, and vacuoles.		4:90-101 4:120	Pt. 5: 147-159 Pt. 6: 143-152	5:21-56		
3. Classifying insect coloration as aggressive/protective or warning.		6:282-283				
4. Classifying insects based on physical characteristics.	OBSERVING INSECTS COLLECTING INSECTS CLASSIFYING INSECTS	5:40-41 5:60-69				
5. Recalling that an insect's body covering is its skeleton.						
6. Interpreting a graph showing temperature survival ranges for molds and spores.		5:78-83	Pt. 5: 119-125			

GRADE SIX RELATED MATERIALS 6:7-13

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
7. Applying the concept of the web of life.		5:280-293 5:310-311 6:296-297		6:89-102		
8. Applying the concept of Mendelian dominance.		6:188-191		6:380-396		
9. Applying the concept of simple Mendelian inheritance.		6:184-188 6:254-255	Pt. 6: 177-184	6:380-396		
10. Explaining abnormal predator/prey population sizes.	DESCRIBING PREDATOR/PREY RELATIONSHIPS	5:306-308 6:232-241				
11. Describing the dominant animals and plants in a community.		5:300-301				
12. Listing procedures needed to insure the survival of Earthlings.	CONSERVING WATER					
13. Inferring the effect of observing a solar eclipse.			Pt. 7: 237-247			

GRADE SIX RELATED MATERIALS 6:14-18

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
14. Identifying the variables that change the speed of the swing of a pendulum.			Pt. 5: 181-189	6:426-443		
15. Indicating the operational definition of oxygen.	TESTING FOR OXYGEN PRODUCING CARBON DIOXIDE DESCRIBING THE OPERATION OF A FIRE EXTINGUISHER	4:170-171 4:257-258	Pt. 7: 119-126 137-144	6:43-64		
16. Stating that heat increases the saturation point of a solution.				5:140-170 6:283-294		
17. Recalling that in changes from solid to liquid to gas, molecules spread apart.		5:231	Pt. 6: 233-246	6:248-282		
18. Identifying the states of matter from among diagrams of molecules.		5:230 5:240-247				

GRADE SIX RELATED MATERIALS

6:19-24

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
19. Classifying solids.		5:220-224 5:236-239				
20. Determining the volume of air space in sand.						
21. Predicting that sound travels faster in a solid.	DESCRIBING HOW SOUND TRAVELS	4:225-231				
22. Identifying statements about the properties of sound.	SEEING SOUND - WAVES	4:210-231				
23. Controlling pitch.	REGULATING THE PITCH OF VIBRATING STRINGS CHANGING PITCHES USING RUBBER BANDS	4:217-224				
24. Computing the force required using a lever, pulley, and wheel and axle.		5:194-203 6:123-131	Pt. 4: 173-178 Pt. 5: 239-243	6:408-414		

GRADE SIX RELATED MATERIALS

6:25-31

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
25. Computing the amount of work accomplished.				5:84-115		
26. Measuring the forces required to lift vertically and with an inclined plane.		5:190-193 6:108-109 6:128-131	Pt. 5: 29-36 Pt. 7: 197-213	6:415-425		
27. Inferring that force without motion was insufficient to overcome friction.		5:188-189 6:104-107	Pt. 6: 93-102			
28. Sharing equal amounts of energy among individuals.		6:242-261 6:270				
29. Ordering energy sources by their historical development.						
30. Explaining the formation of the solar system.						
31. Observing reactions in two aquarium environments.		5:293				

GRADE SIX RELATED MATERIALS

6:32-38

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
32. Describing what happens to limestone surrounding an igneous intrusion.		6:222-223				
33. Describing the direction of applied force in folded sedimentary rock.		5:152-157 5:172-174				
34. Measuring the temperature of soil at various depths.				6:18-42		
35. Determining the hardness of rocks.		5:225 6:224-225	Pt. 5: 113-118			
36. Proposing permanent long-range solutions for the ecological crisis.		5:178-179 6:262-265				
37. Predicting the consequences of fuel reserve lifetimes.		6:288-295 6:304-305				
38. Identifying continental slope and shelf, abyssal plain, & mid-oceanic ridge.						

GRADE SIX RELATED MATERIALS 6:39-45

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
39. Applying the rule that a liquid will sink below any less dense liquid.		5:118-123	Pt. 7: 1-19			
40. Determining if marine fish breeding is affected by salinity.			Pt. 6: 221-232			
41. Applying the concept of convection.		5:116-141				
42. Selecting the earth-atmosphere condition characterizing a greenhouse effect.		4:269-270	Pt. 7: 81-90			
43. Differentiating between humidity and relative humidity.		6:42-45		6:65-88		
44. Predicting the approximate prevailing wind direction for a given pressure.		5:126-127 6:51-67				
45. Applying the concept of the sea breeze.		5:130-141				

GRADE SIX RELATED MATERIALS 6:46-52

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
46. Applying scale concepts to determine the width of a crater.			Pt. 7: 215-230			
47. Ranking survival items after crash on the moon.		5:260				
48. Selecting the rock that could not be collected on the moon.		5:277-279 6:206-207				
49. Inferring why the moon has no atmosphere.						
50. Labeling moon features according to age.		5:278				
51. Recalling the phases of the moon.		6:71	Pt. 5: 191-200			
52. Determining the relative sizes of Sun and Earth.		6:98-99	Pt. 5: 191-200			

GRADE SIX RELATED MATERIALS 6:53-59

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77	AAAS	COPES NYU '77		
53. Computing weight on another planet.						
54. Determining whether man could journey to Proxima Centauri in one lifetime.						
55. Determining why stars seen during winter cannot be seen in summer.		6:72-101				
56. Explaining various positions of the setting sun on the horizon.		6:76-79				
57. Explaining the apparent east-west motion of the stars in the sky.	OBSERVING THE STARS IN THE NIGHT SKY	4:198-201 6:68-69 6:92-101				
58. Choosing to go to the moon or develop instrumentation to perform function.		5:250-279				
59. Substantiating a rationale for manned space flights by the U. S.						

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GRADE SIX RELATED MATERIALS

6:60

OBJECTIVES	RELATED ACTIVITIES	ADDISON-WESLEY '77		COPES NYU		
60. Stating some current benefits of space research in medicine.						

6:1-4

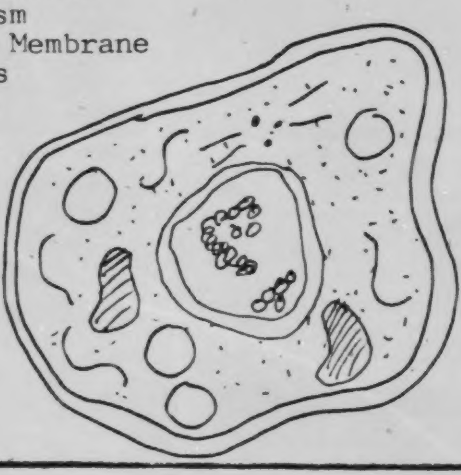
GRADE SIX ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

1. A student in a sixth grade science class was experimenting with water loss from plants. As a result of his experiment, he concluded that the number of leaves on a plant are proportional to the amount of water taken in and lost by the plant. Identify the manipulated and responding variables.

   (Answers: manipulated - amount of water; responding - number of leaves.)

2. Below are the names of five parts of a cell. Identify the following five parts by drawing an arrow to each and putting the number of that part on the arrow.

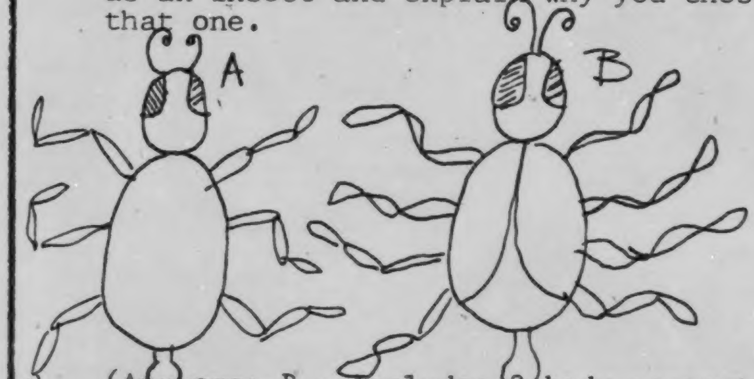
   (1) Cell Membrane
   (2) Cytoplasm
   (3) Nuclear Membrane
   (4) Vacuoles
   (5) Nucleus



3. Provide either mounted or colored pictures of: (1) a bumble bee, (2) a butterfly, and (3) a wasp. Say: Which of these insects display a warning coloration and which display an aggressive/protective coloration?

   (Answers: Conspicuously colored insects are usually so colored to warn predators that they are dangerous, while insects colored to blend with their environment are usually so colored for concealment for either aggressive or protective behavior.)

4. The drawings below represent two newly discovered 'bugs'. Place an X next to the one which could be identified as an insect and explain why you chose that one.



   (Answers: B - includes 3 body segments and wings.)

GRADE SIX ASSESSMENT ITEMS

BIOLOGICAL SCIENCES

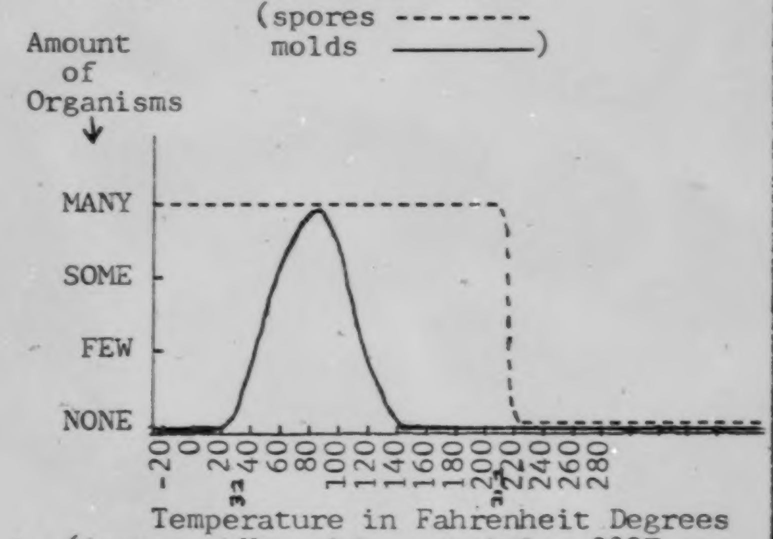
6:5-7

5. An insect's skeleton is different from ours. Describe an insect's skeleton.

(Answer: The body covering of an insect is also its skeleton.)

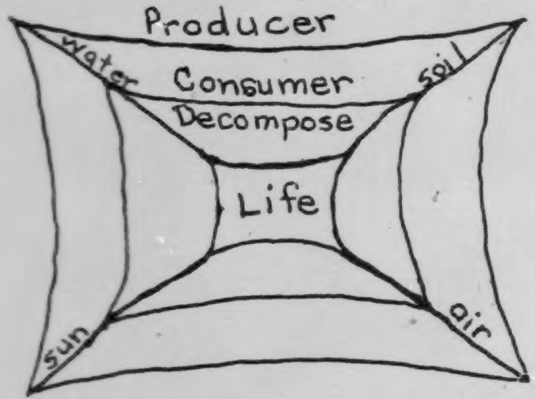
6. From the graph below, what general interpretation can you make about the ranges of mold growth and spore survival?

RELATIONSHIP OF MOLD GROWTH AND SPORE SURVIVAL TO TEMPERATURE



(Answers: No molds grow below 20°F or above 140°F, but spores may survive from -20°F to 220°F.)

7. This is a representation of John Storer's Web of Life. Knowing that all things depend on each other and their surroundings, tell in your own words how a backyard can be made to demonstrate the Web of Life.



(Answer: Explanation must include that all life in the backyard depends upon energy from the sun for food and how each organism depends upon others in the backyard.)

8. A tall bean plant was found. Tallness in bean plants is a dominant trait. If T represents the dominant trait (tall) and t represents the recessive trait (not tall), what are the possible genotypes of this plant's parents?

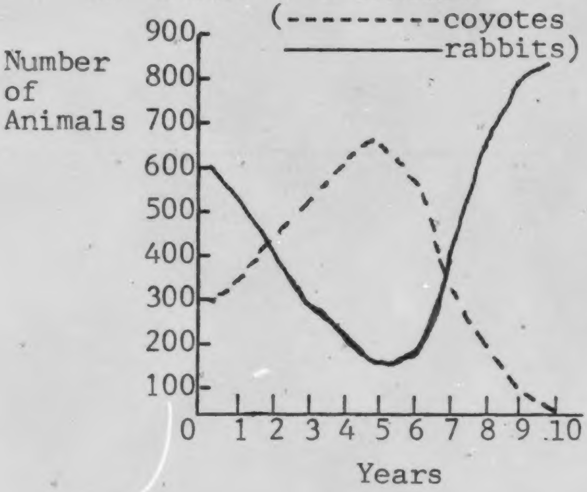
(Answers: The explanation must apply the concept of Mendelian dominance by including: the parents could be TT-TT; TT-Tt; TT-tt; Tt-TT; Tt-Tt; Tt-tt; tt-TT; or tt-Tt; where T = dominant and t = recessive.)

9. Susan, who had a genotype - genes which make up a characteristic - of AO for her blood type, married Sam, who had a genotype of BO for his blood type. They had a child, Sandy. What could be the possible genotype for her blood type?

(Answers: The explanation must apply the concept of simple Mendelian inheritance by listing the genotypes of the offspring of the union: AO; BO; OO; AB.)

10. Below is a graph that shows the population of coyotes in a county in Florida along with the population of rabbits in the same county. It is known that coyotes eat rabbits. Notice that the graph shows a pattern for both populations for the first seven years. This pattern of rise and fall is the natural pattern. For years seven through ten the pattern becomes abnormal and the coyotes all but disappear. Tell what might have caused this abnormality and what you would do to find out if you were right.

POPULATIONS OF COYOTE AND RABBIT IN COUNTY X IN FLORIDA



(Answers: The explanation must include an inference and a test of the inference.)

GRADE SIX ASSESSMENT ITEMS
BIOLOGICAL SCIENCES

11. Pick a natural community of your choice and report to the class your findings about the dominant animals and plants of that community and why you chose that particular community.

    (Answer: Report must include a description of the dominant animals and plants and the reasons for interest in the particular community.)

12. When astronauts go into outer space, everything which enables them to survive must be included such as atmosphere, food, and energy. Earth is like a spaceship because everything which is needed for survival has been included. Recently, man has almost used up some of these items. Briefly list 3 ways which are important so that man can ensure a long safe journey on spaceship Earth.

    (Answers: List should include such items as conservation of resources, new energy sources, etc.)

13. Researchers have determined that ultraviolet light rays permanently damage the retina of the eye due to burning the rods and cones which impairs the vision or totally blinds the individual. By studying the table below, state an inference concerning an effect to be considered while observing solar eclipse.

SPECTRUM OF SUNLIGHT

ULTRAVIOLET
VIOLET
BLUE
GREEN
YELLOW
ORANGE
RED
INFRARED

(Answer: Student infers the possible negative effect as a result of observing a solar eclipse.)

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14. Provide a demonstration of the swing of a pendulum (a rubber ball, a piece of string, and a hand). Say: When watching the swing of this pendulum, observe the time that it takes for the ball to swing back and forth. Put an X by each variable that, when changed, will either speed up or slow down the swing of the pendulum.

___(1) the color of the ball
___(2) the material the string is made of
___(3) the weight of the ball
___(4) the length of the string from the ball to the hand
___(5) the strength of the person who is holding the string
___(6) the amount of light striking the ball
___(7) how big a push starts the ball swinging

(Answers: 3, 4, 7.)

15. Provide a demonstration where glowing splints are placed into labeled inverted beakers of carbon dioxide gas and oxygen gas. Say: You have watched me place a glowing splint into each of these labeled beakers. Using this demonstration, write an operational definition of oxygen.

(Answer: The operational definition must include that oxygen is a gas that causes a glowing splint to burst into flames when the splint is placed into a container of the gas.)

16. Provide a demonstration in which heat is applied to a saturated solution of water and baking soda and more baking soda is added after heating. Say: You have seen a demonstration of heat being applied to a saturated solution of baking soda and water. Write an explanation telling why more baking soda can be put into solution when heat is applied.

(Answer: Heat increases the saturation point of a solution.)

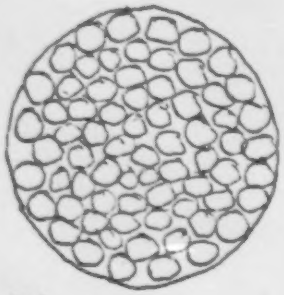
17. As a substance changes states from a solid to a liquid to a gas, what happens to the molecules of that substance?

(Answer: The molecules are spread farther apart and move with more freedom as a substance changes states from a solid to a liquid to a gas.)

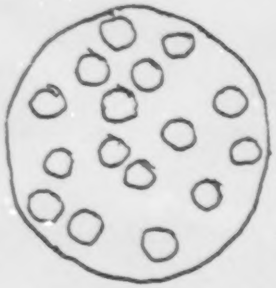
6:18-19

GRADE SIX ASSESSMENT ITEMS
PHYSICAL SCIENCES

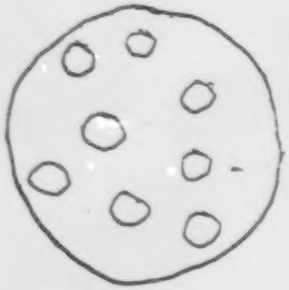
18. Here are three diagrams of molecules. Label the diagrams as either a liquid, solid, or gas on the line underneath each diagram.



(1) ____________



(2) ____________



(3) ____________

(Answers: 1-solid, 2-liquid, 3-gas.)

19. Provide six labeled white solid mixtures (e.g., baking soda, baking powder, cornstarch, powdered chalk, powdered sugar, talcum powder); a supply of water, vinegar, and iodine solution; containers; and stirrers. Say: Using the materials given you, test each labeled solid and classify each solid into one of the following categories:

(1) soluble in water, foams in vinegar foams in water;
(2) soluble in water, foams in vinegar, does not foam in water;
(3) soluble in water, does not foam in vinegar;
(4) not soluble in water, does not foam in vinegar, turns blue-black in iodine solution;
(5) not soluble in water, does not in vinegar, does not turn blue-black in iodine solution;
(6) not soluble in water, foams in vinegar.

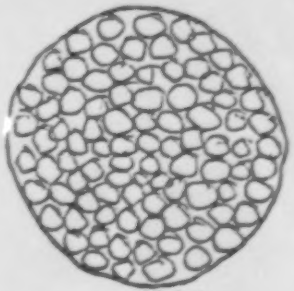
(Answers: 1-baking powder; 2-baking soda; 3-powdered sugar; 4-cornstarch; 5-talcum powder; 6-powdered chalk.)

20. If you could use any or all of the equipment on this list, how would you determine the volume of air space in the sand? Explain the procedure listing its steps in their proper order.

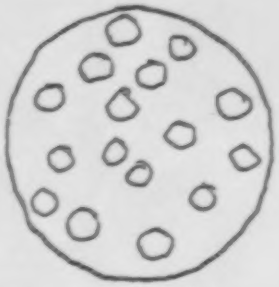
(1) beaker of sand
(2) graduated cylinder
(3) a water supply
(4) an empty beaker

(Answer: STEPS TO FOLLOW:
(1) pour some of the sand into the graduated cylinder and record the volume of air space in the sand
(2) pour this measured amount of sand into an empty beaker
(3) pour some water into the cylinder and record the volume of water
(4) add the measured amount of sand and record the volume of water
(5) subtract volume in step 3 from volume in step 4 to obtain the volume of sand without air
(6) subtract volume of step 5 from volume of step 1 to obtain the volume of air space in the sand.)

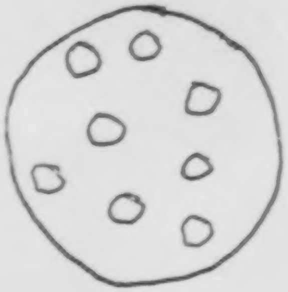
21. Here is a hypothesis: the closer together molecules are the faster sound will travel. Using these drawings of the molecules of a solid, a liquid, and a gas, tell me in which state of matter sound will travel the fastest.



solid



liquid



gas

(Answer: solid.)

GRADE SIX ASSESSMENT ITEMS
PHYSICAL SCIENCES

22. Here is a list of statements about the properties of sound. Put an X only by those statements you think are true.

___(1) Sound can travel in a vacuum.
___(2) Sounds are loudest near the source.
___(3) Sound can travel faster than light can travel.
___(4) Not all vibrating objects make a sound.
___(5) Sound travels in all directions from its source.
___(6) An echo is a sound wave which bounces back in the direction from which it started.

(Answers: 2, 4, 5, 6.)

23. Provide a demonstration of vibrating a string or rubber band to produce a sound. Say: You have watched me make a sound by vibrating this string. Name three ways the pitch or frequency of a vibrating string can be controlled.

(Answers: the length of the string, the thickness of the string, the tension on the string.)

24. Below are three questions about a lever, a pulley, and a wheel and axle system. Compute the amount of force in pounds needed to move the load.

(1) A man wants to raise a 200-pound rock with a 6 foot crowbar. He places the fulcrum 2 feet from the rock. How much effort force must the man exert to lift the rock?
(2) Suppose you have a load that has to be lifted. The load weighs 500 pounds and you are using a block and tackle system with 2 pulleys in each block giving you 4 supporting ropes. How much effort will you need to raise the load?
(3) If the diameter of a steering wheel of a car is 30 inches and the axle is 2 inches, how much force must be applied to the wheel for the axle to apply a force of 150 pounds?

(Answers: 1-50 pounds; 2-125 pounds 3-10 pounds. Two out of the three questions must be answered correctly.)

25. If I were to push with a 10 pound force for 50 feet, how much work would I accomplish?

(Answer: Multiply the force exerted by the distance moved - 500 foot-pounds.)

26. Before you are the following materials:
   (1) roller skate
   (2) a board that can be used as an inclined plane
   (3) a spring scale
   (4) a stack of books

Using any or all of these materials, demonstrate how the force needed to lift the skate to the top of the stack of books is less when you use the inclined plane than when you lift the skate straight up to the top of the stack of books.

(Answer: Equipment is manipulated and results are recorded in regard to the force needed to lift the skate vertically and the force needed to lift the skate by using the inclined plane. Finally, the results are compared. Students should exert a regular pull at the same speed for both measurements.)

27. Provide a demonstration of applying a horizontal force on a desk without setting it in motion and another application of force in the same direction setting the desk in motion. Say: You have seen two horizontal forces acting in the same direction. Tell me why the first push didn't move the desk.

(Answer: The first force was less than or equal to the frictional force, and no motion resulted.)

28. Imagine this situation, "Three individuals, Mr. Jones, Mr. Smith, and Mr. Brown, get their energy from the same generator. They share equally the 24 units of electricity the generator supplies. Due to an increase in population, a new person, Mr. Thomas, is assigned to the same generator." Write two ways Mr. Thomas can receive an equal amount of electricity.

(Answer: The first three individuals have to cut down equally upon their energy usage or all four individuals require a more plentiful source.)

State an advantage and a disadvantage for using natural gas as a source of energy.

29. Arrange this list of energy sources from the earliest source man used to the most recent energy source man uses today.
   (1) electricity
   (2) coal
   (3) nuclear
   (4) petroleum
   (5) wood

(Answers: 5, 2, 4, 1, 3.)

6:30-32

GRADE SIX ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

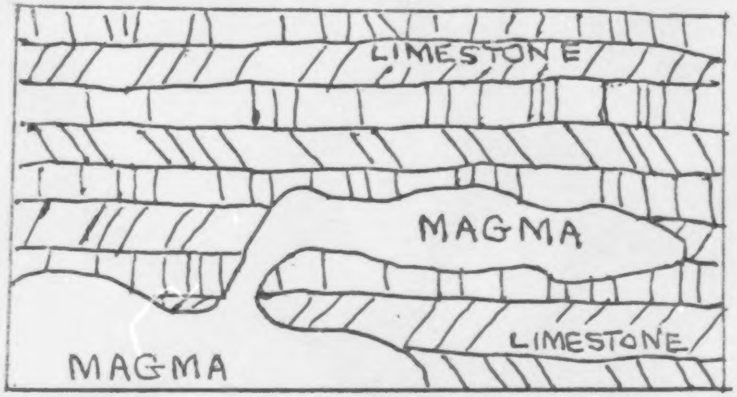
30. What are three theories that have been developed to explain the formation of the solar system? Describe each one.

(Answers: (1) Close Approach Theory - a star passing close to the sun - matter was drawn away from each star, the gaseous matter cooled and formed solid pieces to form planets and other parts of the solar system; (2) Exploding Companion Star Theory - our sun had an exploding companion star - material from the exploding star was captured by the sun's gravity, this cloud of gas eventually formed various parts of the solar system; (3) Gas-Cloud Theory or Dust Cloud Theory - a slowly rotating nebula of gas and dust developed whirlpools of various sizes within the cloud with continued shrinking, the center of the cloud became the young sun, each of the snall whirlpools condensed to become solid planets.

31. Provide a quart jar, a 10 gallon tank, 8 healthy gold fish, water that has stood in the room for 24 hours, aquatic plants, snails, gravel, pH kit. Say: Observe and record data for one month to find out what happens to organisms under different environmental conditions related to living space.

(Answer: Observations must include such variables as plant life, food, snails, pH of water.)

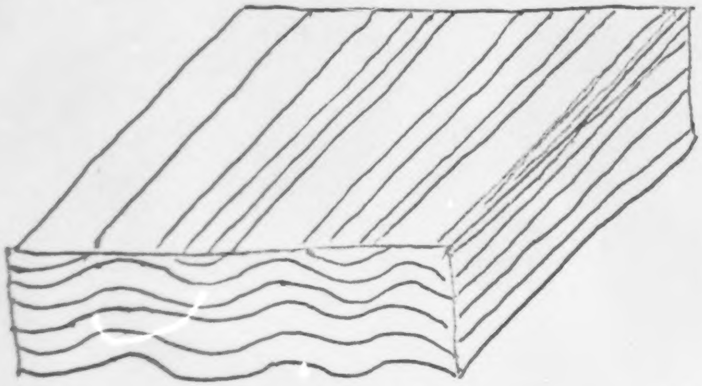
32. Here is a diagram of magma flowing along a crack between two layers of limestone. What two things will happen to the limestone near the magma?



(Answer: The surrounding limestone will be affected by the heat and will be changed or metamorphised into the metamorphic rock marble.)

GRADE SIX ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

33. This diagram illustrates rock strata that have been compressed into folds. Draw an arrow to show in which direction the force was applied to cause the pressure to fold the rocks.



(Answer: Forces to compress sediments into folds were from the sides - from the direction of the area of the most folds.)

34. Provide a thermometer and a meter stick. Say: Using this thermometer, measure the temperature of soil at the surface, 15 cm below, 30 cm below, and 45 cm below. Make a line graph out of the data that you collect.

35. Here are four rocks (e.g., limestone, obsidian, sandstone, slate). What could you do to find out which is the hardest and what evidence would you need to determine hardness? List the procedures you would use to get the evidence.

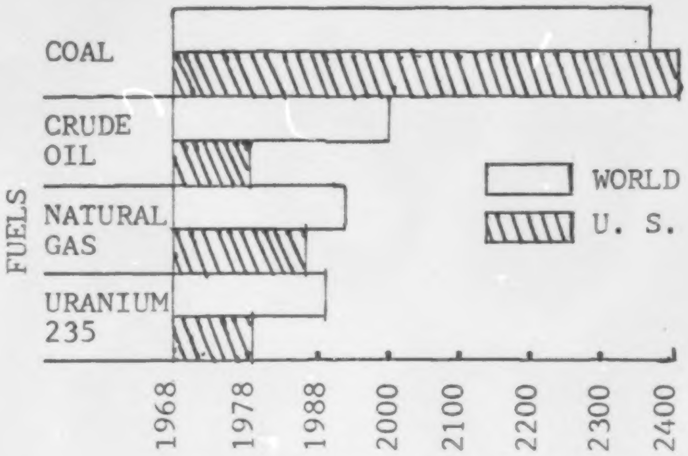
(Answer: The design of the experiment must include the manipulated variable- the kind of rock; the responding variable - the hardness; a procedure for manipulating the variables and those held constant during each manipulation; operational definitions for at least the various kinds of rocks used and "hardest"; materials needed; and methods for collecting and interpreting data.)

36. For each of the following four factors that have caused the present ecological crisis situation on earth, propose a possible long-range solution that you think will help to solve each one.

(1) Imbalance between birth and death rates
(2) GNP based on obsolescence & waste
(3) Finite nature of earth and its mineralized crust
(4) Increased risk of irreversible spoilation of environment

GRADE SIX ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

37. Based on data given in this chart, what do you predict will be some of the future consequences for the people of the world in the year 2000?

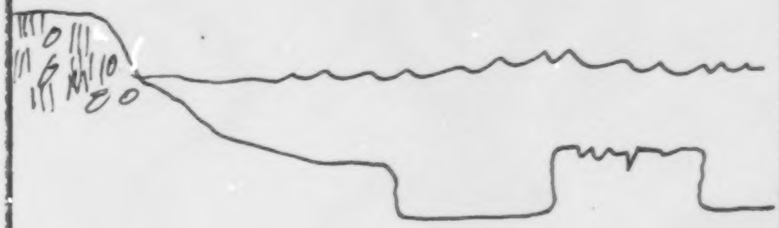

FUEL RESERVES LIFETIME

Based on Known Recoverable Reserves and Existing Rates of Consumption

(Answer: By the year 2000, three of the fuels will be consumed and man will have to seed new energy sources.)

38. Label the following features in the diagram of an ocean basin by drawing an arrow to the appropriate feature and labeling it.

(1) continent
(2) abyssal plain
(3) continental slope
(4) mid-oceanic ridge
(5) continental shelf



39. Three temperatures are reported below from three ocean depths. Arrange them in proper vertical sequence from the bottom up. The temperatures are $22^{\circ}C$, $14^{\circ}C$, and $4^{\circ}C$.

(Answers: $22^{\circ}C$ top
$14^{\circ}C$
$4^{\circ}C$ bottom.)

GRADE SIX ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

6:40-41

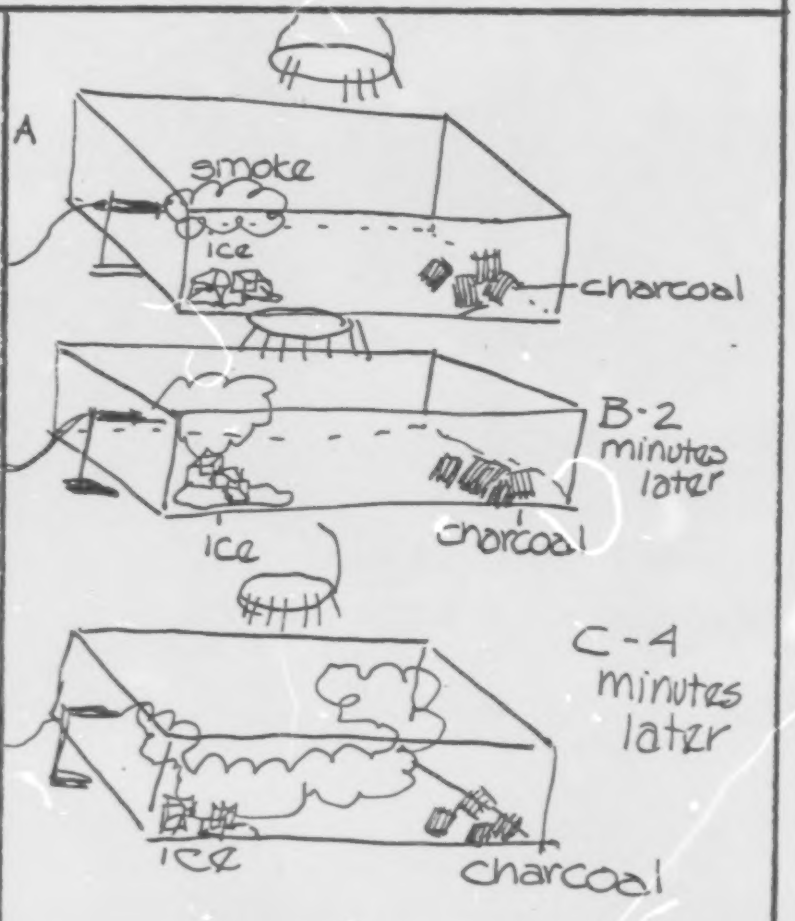
40. Design an experiment to test the hypothesis that marine fish breeding is affected by the salinity of the water. Your design should include the following:

(1) variables
(2) procedures to be followed
(3) equipment to be used
(4) data to be collected

(Answers: variables to be controlled - at least three - temperature, volume of tanks, surface area of tanks, food, oxygen content; procedures to be followed; equipment to be used; definitions needed; data to be collected; methods of interpreting the data; manipulating, responding, and controlled variables; how variables are to be manipulated; observation procedures.)

41. The diagrams illustrate a sequence of events. Why, in the last diagram, does the smoke move up over the warmer area and down over the colder area?

(Answers: The smoke follows the paths of the air and rises over the warmer soil and sinks over the ice since warm air is less dense than cool air.)



42. Place an X by the explanation below that best characterizes the "greenhouse effect."

___(1) The Earth and the atmosphere are warmed as the sunlight passes through the air and strikes the surface.

___(2) The sunlight changes to heat as it passes through the atmosphere, but it warms the surface first which in turn warms the atmosphere.

___(3) The sunlight changes to heat when it hits the surface which in turn warms the atmosphere.

(Answer: #3.)

43. Match the definitions with the appropriate words or terms that they define:

___(1) Humidity ___(2) Relative Humidity

(A) The actual amount of water vapor that the air is holding.

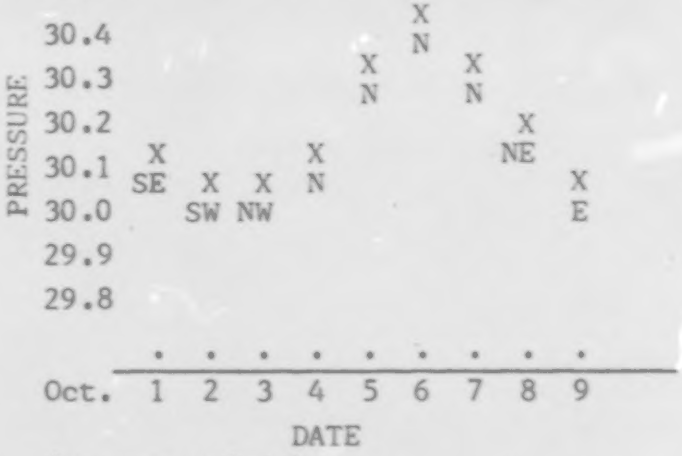
(B) The maximum amount of water vapor that the air can hold at a certain temperature.

(C) The ratio, usually expressed as a percentage, which compares the amount of water vapor that the air is holding to the amount of water vapor that the air can hold under the same conditions.

(D) The comparison of the amount of water vapor that the air could hold to the amount that the air is holding under the same conditions.

(Answers: 1-A, 2-C.)

44. The data in the graph below show wind direction and pressure. What will the wind direction be on December 10 if the pressure is 30.2 inches of mercury?



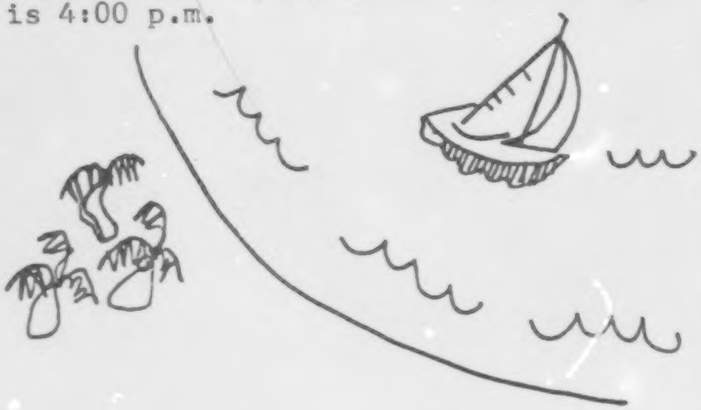
(Answer: N/NE.)

GRADE SIX ASSESSMENT ITEMS

6:45-46

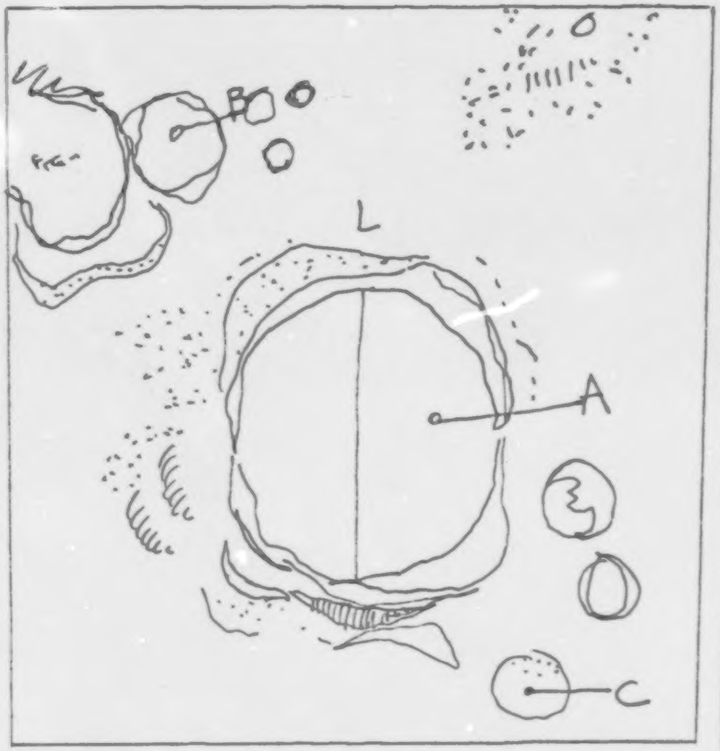
EARTH-SPACE SCIENCES

45. Indicate on the diagram the direction the sailboat should be heading to attain maximum speed if the time of day is 4:00 p.m.



(Answer: At 4:00 p.m. in order to attain maximum speed, the boat should take advantage of the seabreeze and sail directly toward the shore.)

46. The map shows several features on the moon. Using the ruler, determine the actual width of crater A along line L-L and state your answer in kilometers.



SCALE: 1 CM = 20 KM

6:47-50

GRADE SIX ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

47. Imagine you are a member of a moon landing crew and your space ship has crashed on the lighted side of the moon. Your survival depends on reaching a moon base 200 miles away. Below are listed 8 items left intact after landing. Rank them in order of importance in terms of reaching the moon base. Place number 1 by the most important, number 2 by the second most important, and so on.

___50 feet nylon rope
___45 calibre pistol
___star map
___5 gallons of water
___box matches
___two 100-pound tanks of oxygen
___food concentrate
___life raft

Explain your choices.

(Answer: The ranking is irrelevant, but the reasons should be consistent with the choices.)

48. On your table are two rocks (2 samples of a dark colored igneous rock - gabbro or basalt, one showing discoloration). Which one could not have been found on the moon? Explain how you know this.

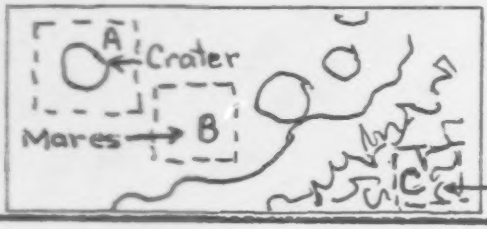
(Answer: The weathered rock could not have been found on the moon. The discolored rock has been weathered.)

49. Which of the following statements do you think explains why the moon has no atmosphere? Place an X next to the one you think is correct.

___(1) There were never any gases on the moon.
___(2) The gases making up the moon's atmosphere escaped into space because of the moon's low gravity.
___(3) The gases were pulled off the moon by the strong gravitational pull of Earth.

(Answer: #2 - The low gravitational field of the moon prevented the retention of gases.)

50. The map below shows a region of the moon with three areas marked. In the spaces to the right of the map, place the letters of the features in order by age, listing the youngest first.



* * * * *

__youngest

___

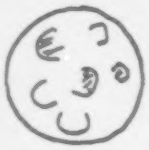
___

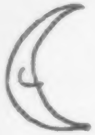
* * * * *

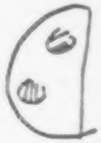
GRADE SIX ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

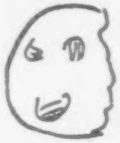
51. Examine the illustration. Shown are four phases of the moon. Match the illustrations to the list of names by placing the correct letter for the phase in the space to the left of the names.

____(1) crescent
____(2) full
____(3) gibbous
____(4) quarter


A

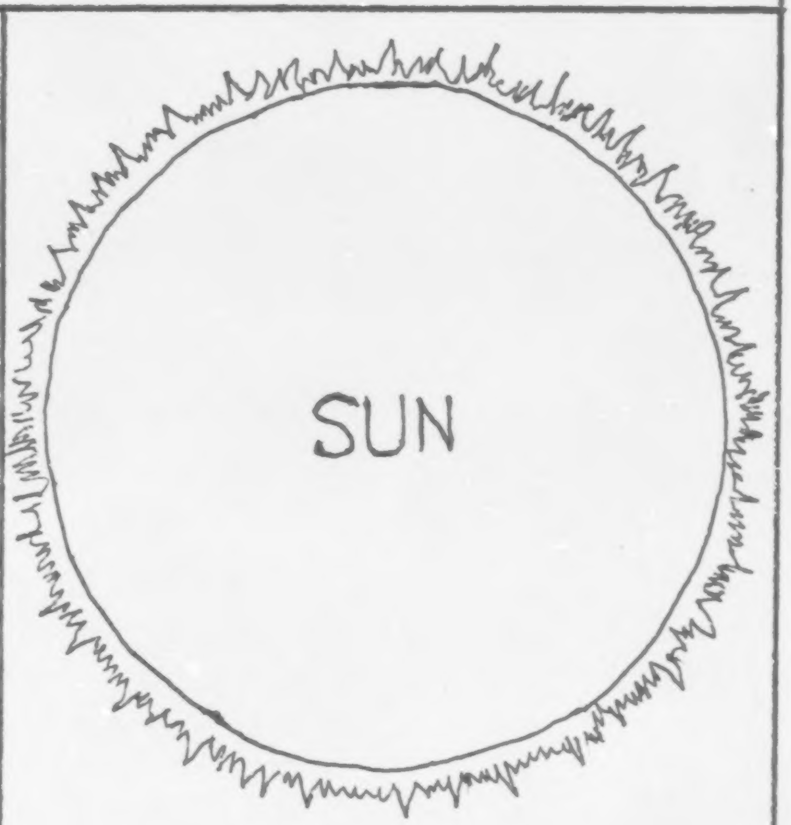

B


C


D

(Answers: 1-B, 2-A, 3-D, 4-C.)

52. The drawing of a circle represents the sun. Astronomers have determined that the sun is about 100 times larger than earth. Using a metric ruler and this information, how large would one circle be to represent the size of the earth in comparison to the diagram of the sun below?



GRADE SIX ASSESSMENT ITEMS
EARTH-SPACE SCIENCES

53. The chart shows the surface gravities of three planets relative to Earth (Earth = 1.0). If an astronaut who weighs 200 pounds on Earth were to travel to each planet, how much would he weigh on each of these planets?

Planet	Surface Gravity Relative to Earth	Weight of Astronaut
2	0.4	
3	1.5	
4	1.1	

(Answers: Weight on another planet is the product of earth weight time surface gravity relative to earth - #2 - 80 lb.; #3 - 300 lb.; #4 - 220 lb.)

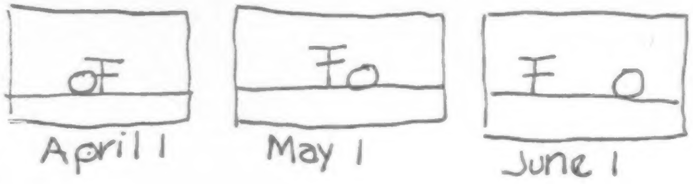
54. Proxima Centauri, the closest star, is about 40 trillion km. away, or about 4.3 light years away. (Light travels 300,000 km/sec.) If a rocket could travel 300,000 km/hr, how long would it take to reach Proxima Centauri? Could astronauts make a journey there in one lifetime?

(Answer: Traveling at a rate of 300,000 km/hr, it would take 15,221 years to reach Proxima Centauri. It would not be possible in one lifetime.)

55. Some stars seen in the winter cannot be seen in the summer. Explain how this phenomenon can occur.

(Answer: Since the earth's axis is not perpendicular to a line drawn from the earth to the sun, different parts of the night sky will be seen during the summer and winter as the earth revolves around the sun.)

56. From the diagram, the sun sets at different points on the horizon at different times during the year. Explain why.



(Answer: Since the earth is tilted on its axis, different points on the earth are perpendicular to the sun's rays as the earth revolves around the sun, therefore, the sun will set at different points on the horizon.)

GRADE SIX ASSESSMENT ITEMS

EARTH-SPACE SCIENCES

57. When one observes the night sky, the stars seem to move from east to the west. Why is the motion from east to west?

(Answer: Since the earth rotates on its axis from west to east, the stars appear to move from east to west since they are at such great distances that motion is not apparent.)

58. As a geologist, you are given the choice of traveling to the moon to collect rock samples or developing instrumentation which could gather the same samples. Which would you choose and why?

(Answer: The choice is irrelevant, but the reason for the choice should be logical.)

59. The U. S. has supported manned space flight through many different space programs. Choose the most relevant rationale for manned space flight based on society today. State your reasons why.

(1) Man can think better in space since he has a different perspective on earth.
(2) Men can see many things cameras can't.
(3) Physiological studies can best be done on man rather than monkeys or other such animals.
(4) Men may be required to fix broken equipment.

(Answer: The choice is irrelevant but the reasons for the choice should be logical.)

60. State some current benefits of space research as applied to medicine.

(Answer: Response must include such areas as improving medical techniques, diagnostic methods, and treatment systems. Some of the following should be indicated: electronic pacemaker, radio-linked automatic patient monitoring system, diagnosis of respiratory diseases using non-invasive physiological measuring techniques, sprayed on electrodes for electrocardiogram, portable volume-controlled respirator, muscle accelerometer-measures minute muscular tremors, sight switch-activated by a mere movement of the eye, sound converter-converts audio sound to vibrations - used by deaf people to 'hear' through fingertips.)

APPENDIX D

DISSEMINATION RESPONSES

KEY BISCAYNE COMMUNITY SCHOOL
OFFICE OF THE PRINCIPAL
150 WEST McINTYRE STREET KEY BISCAYNE, FLORIDA 33149
PHONE 361-5418

FRANCIS G. DeLAURIER
PRINCIPAL

DR. J. L. JONES
SUPT. DADE COUNTY SCHOOLS

August 30, 1978

Jean Moeller
7510 S.W. 141st Avenue
Miami, Florida 33183

Dear Mrs. Moeller:

The science bulletin and school based management system that you provided for personnel at Key Biscayne Community School has served to encourage and facilitate our ongoing program improvement efforts.

The guidelines of the management system specify a structure that appropriately responds to a multitude of program ills. Although each of the implementation procedures is important, the component on needs describes activities that are generally overlooked but essential to success. The procedures manual is a valuable contributor to the support and improvement of the teaching/learning situation.

Because the control group for program evaluation was comprised of students from Key Biscayne Community School, it was especially interesting to review the science bulletin that was generated as a part of the activities. Further insight into the effort involved and other aspects of the generation of the bulletin was provided by a participant in the South Central Curriculum Center's effort to organize the Florida Catalog of Science Objectives who is now a teacher at Key Biscayne Community School. The bulletin effectively provides a much needed program structure to support and guide the teaching of science.

Increasing demands on the public schools have led a growing number of educators to realize the importance of school level decision making skills. Similarly, plans for the 1978-79 school year at Key Biscayne Community School implicate the implementation of a number of the school based management procedures.

Sincerely,

Frank DeLaurier

Frank DeLaurier
Principal

WEST HOMESTEAD ELEMENTARY SCHOOL
1550 S. W. 6TH STREET
HOMESTEAD, FLORIDA

Mr. Richard V. DeVeaux
Principal

Dr. J. L. Jones
Supt. Dade County Schools

August 31, 1978

Dear Jean,

Thank you for the interesting materials. Science Education: Elementary Objectives, Selected Activities and Assessment Items should prove to be very useful as a tool for helping us reach our goals here at West Homestead Elementary. On examining the material I was pleased to see that many of the objectives correlate with skills which we are accountable for in the basic skills areas of reading, mathematics and writing as mandated by state and county.

Teachers have stated that they have difficulty finding time blocks for science because of the emphasis on basic skills. I have maintained that all the objectives can be applied to other areas such as science and social studies. Some teachers have a problem in relating other subject areas to basic skills objectives.

I believe that these science activities will easily bridge the gap between the two areas. I plan to share this material at a Curriculum Council Meeting and make it available to at least one teacher on each grade level.

The document Procedures for Implementing School Based Management of Program Development will be helpful not only as a guide for program development here at the school, but as a guide to assess existing programs.

Sincerely,

Joan H. Rindfuss

Joan H. Rindfuss
Assistant Principal

SEP 01 [illegible]

August 31, 1978

MEMORANDUM

TO: Dr. Jean Moeller

FROM: Harriet Ehrhard

SUBJECT: SCIENCE EDUCATION: ELEMENTARY SCHOOL OBJECTIVES

Thank you for sending me a copy of the material you developed. It represents a tremendous amount of work and is a comprehensive reference.

Last spring I was assigned the task of preparing a concise set of objectives K-6. The people who had served on the Elementary Science Textbook Evaluation Committee also helped with the objectives. Copies should be in your school next week. From a quick look at yours, I believe both sets are somewhat similar. My committee did not do any cross/referencing.

I do appreciate having your bulletin and will use it wisely.

HE:ah

PINE LAKE ELEMENTARY SCHOOL
16700 S.W. 109 AVENUE
MIAMI, FLORIDA 33157

CHARLENE J. HOUGHTON
PRINCIPAL

DR. J. L. JONES
SUPT DADE COUNTY SCHOOLS

September 7, 1978

Ms. Jean Moeller
7510 S. W. 1414 Ave.
Miami, Fla. 33183

Dear Jean:

I have read with interest the manual covering the procedures for implementing a school based management of program development.

I have also perused the bulletin on science education with selected activities and assessment items.

In my opinion, the contents of the manual would satisfy the professional needs of the most exacting teacher(s) and/or administration(s).

I feel that our kindergarten teachers would benefit if copies of the two documents were made available to them. We would need one set for each of our Kindergarten Centers.

Needless to say, all our primary teachers could use the above materials as a supplement to our SAPA program.

Congratulations on an excellent job.

Sincerely,

Marta R. Klovekorn

Marta R. Klovekorn
Assistant Principal

MRK/dp

HOWARD DRIVE SCHOOL
7750 S. W. 136TH STREET
MIAMI, FLORIDA 33156

HAROLD P. SCHMITT
PRINCIPAL

Dr. J.L.Jones
[redacted]
SUPT. DADE COUNTY SCHOOLS

September 19, 1978

Mrs. Jean Moeller
7510 Southwest 141 Avenue
Miami, Florida 33183

Dear Mrs. Moeller:

Thanks so much for sharing with us the valuable materials that were developed under your direction by personnel in the Dade County Public Schools. I have found the science bulletin to be especially beneficial in my particular situation. This kind of program structure has long been needed to facilitate teaching and learning.

The procedures manual has already been used to guide and encourage program improvement efforts at Howard Drive. I strongly urge you to share these materials with administrators throughout the county as needed program improvements can be highly influenced by such positive contributions.

Again, I appreciate your sending the materials.

Sincerely,

Ossie Hollis

(Mrs.) Ossie Hollis
Assistant Principal

LEISURE CITY ELEMENTARY SCHOOL
14950 SOUTHWEST 288TH STREET
HOMESTEAD, FLORIDA 33030

SAMUEL J. RICHIE
PRINCIPAL

DR. E. L. WHIGHAM
SUPT. DADE COUNTY SCHOOLS

October 4, 1978

Jean Moeller
7510 S. W. 141 Avenue
Miami, Florida 33183

Dear Jean,

Thank you very much for sending me the Science Curriculum Guide and Implementation Procedures Manual.

The Curriculum Guide will be very useful in getting our science instruction better organized from the standpoint of positive management practices. It seems rather complete and presented in a very effective format. The Implementation Procedures Manual is timely. It is my opinion that every curriculum guide should have an accompanying implementation procedures manual such as yours.

Sincerely,

W. P. McWhorter
Assistant Principal

WPM:hfm

APPENDIX E

MONITOR LETTERS

CORAL REEF ELEMENTARY SCHOOL
7955 S. W. 152ND STREET
MIAMI, FLORIDA 33157

MICHAEL R. LIEBMAN
PRINCIPAL

DR. J. L. JONES
SUPT. DADE COUNTY SCHOOLS

July 24, 1978

Sam O. Kaylin
Director of Practicums
National Ed. D. Program for
Educational Leaders
Nova University
Rosenthal Building
3301 College Avenue
Fort Lauderdale, Florida 33314

Dear Mr. Kaylin:

Because I had a vested interest in the outcome, I was especially pleased to serve as a practicum monitor for Jean Moeller's individual practicum effort entitled Generating and Implementing School Based Management of Program Development.

As the principal at Pinecrest Elementary School during the practicum implementation, I was intermittently involved in a number of the designated practicum activities. Prior to the implementation, I was provided with a detailed description of the proposed practicum, its objectives, and its intended accomplishments. Then, during the implementation, the status of the activities was periodically reviewed. Finally, I received a report of the results of the practicum effort and a copy of the disseminated materials.

I have concluded that the participant has met and carried out the objectives of the practicum. The results of these efforts should provide direction for other such positive contributions within the school and the school system.

Sincerely,

Michael R. Liebman
Principal

ML:jd

Gulliver Academy, Inc.

12595 RED ROAD
CORAL GABLES, FLORIDA 33156

TELEPHONE 665-3593

MARIAN KRUTULIS
DIRECTOR

October 19, 1978

Mr. Sam O. Kaylin
Director of Practicums
National Ed. D. Program for
Educational Leaders
Nova University
Rosenthal Building
3310 College Avenue
Ft. Lauderdale, Florida 33314

Dear Mr. Kaylin:

I have agreed to be a practicum monitor for Jean Moeller in connection with her individual practicum effort for Nova University entitled Generating and Implementing School Based Management of Programs Development.

I have been in receipt of information related to:

1. purpose and intent of the practicum,
2. progress reports, and
3. a report of the results of the practicum effort, including a copy of the staff development component design, the procedures manual on school based management, and the science education bulletin disseminated as part of the practicum effort.

On the basis of the evidence presented to me, I have concluded that the participant has met and carried out the objectives of the practicum as outlined to me. I find the results to be satisfactory.

Sincerely,

Dorothy Isbell

Dorothy Isbell
Assistant Director